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# WORK PLAN

FOR

WATERSHED PROTECTION, FLOOD PREVENTION,  
AND AGRICULTURAL WATER MANAGEMENT

## CAMERON - CREOLE WATERSHED

CAMERON PARISH, LOUISIANA



JANUARY 1967

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SUPPLEMENTAL WATERSHED WORK PLAN AGREEMENT

between the

CAMERON PARISH GRAVITY DRAINAGE DISTRICT NO. 3

Local Organization

CAMERON PARISH GRAVITY DRAINAGE DISTRICT NO. 4

Local Organization

GULF COAST SOIL AND WATER CONSERVATION DISTRICT

Local Organization

CAMERON PARISH POLICE JURY

Local Organization

(hereinafter referred to as the Sponsoring Local Organizations)

State of Louisiana

and the

Soil Conservation Service

United States Department of Agriculture  
(hereinafter referred to as the Service)

Whereas, the Watershed Work Plan Agreement for CAMERON-CREOLE WATERSHED, State of Louisiana, executed by the Sponsoring Local Organizations named therein and the Service, became effective on the 1st day of April, 1969; and

Whereas, in order to carry out the watershed work plan for said watershed, it has become necessary to modify said Watershed Work Plan Agreement;

Now, therefore, the Sponsoring Local Organizations and the Service hereby agree to modify said Watershed Work Plan Agreement to add the following item:

14. The Sponsoring Local Organizations will provide relocation advisory assistance services and make the relocation payments to displaced persons as required by the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646, 84 Stat. 1894) effective as of January 2, 1971, and the Regulations issued by the Secretary of Agriculture pursuant thereto. Prior to July 1, 1972, the Sponsoring Local Organizations will comply with the real property acquisition policies contained in said Act and Regulations to the extent that they are legally able to do

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so in accordance with their state law. After July 1, 1972, the real property acquisition policies contained in said Act shall be followed in all cases.

The Service will bear 100 percent of the first \$25,000 of relocation payment costs for any person, business, or farm operation displaced prior to July 1, 1972. Any such costs for a single dislocation in excess of \$25,000 and all costs for relocation payments for persons displaced after July 1, 1972, will be shared by the Sponsoring Local Organizations and the Service as follows:

	Sponsoring Local Organizations (Percent)	Service (Percent)	Estimated Relocation Payment Costs (Dollars)
Relocation Payments	28	72	0 <sup>1/</sup>

<sup>1/</sup> Investigation has disclosed that under present conditions the project measures will not result in the displacement of any persons, business, or farm operation. However, if relocations become necessary, relocation payments will be cost-shared in accordance with the percentages shown.

The Sponsoring Local Organizations and the Service further agree to all other terms, conditions, and stipulations of said Watershed Work Plan Agreement not modified herein.





CAMERON PARISH GRAVITY DRAINAGE DISTRICT  
NO. 3Local OrganizationBy /s/ J. A. DavisTitle ChairmanDate 10/20/71

The signing of this agreement was authorized by a resolution of the governing body of the CAMERON PARISH GRAVITY DRAINAGE DISTRICT NO. 3, adopted at a meeting held on October 20, 1971.

/s/ E. J. DronetSecretary, Cameron Parish Gravity  
Drainage District No. 3Date 10/20/71

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CAMERON PARISH GRAVITY DRAINAGE DISTRICT  
NO. 4Local OrganizationBy /s/ Joe P. RutherfordTitle ChairmanDate 10/20/71

The signing of this agreement was authorized by a resolution of the governing body of the CAMERON PARISH GRAVITY DRAINAGE DISTRICT NO. 4, adopted at a meeting held on October 20, 1971.

/s/ Dalton J. RichardSecretary, Cameron Parish Gravity  
District No. 4Date 10/20/71



GULF COAST SOIL AND WATER CONSERVATION  
DISTRICTLocal OrganizationBy /s/ Tom ThomasTitle ChairmanDate 10/14/71

The signing of this agreement was authorized by a resolution of the governing body of the GULF COAST SOIL AND WATER CONSERVATION DISTRICT adopted at a meeting held on October 14, 1971.

/s/ Raymond O. ReedsSecretary, Gulf Coast Soil and Water  
Conservation DistrictDate October 14, 1971CAMERON PARISH POLICE JURYLocal OrganizationBy /s/ W. F. Henry, Jr.Title PresidentDate 12/7/71

The signing of this agreement was authorized by a resolution of the governing body of the CAMERON PARISH POLICE JURY adopted at a meeting held on December 7, 1971.

/s/ Jerry JonesSecretary, Cameron Parish Police JuryDate December 7, 1971



Soil Conservation Service  
UNITED STATES DEPARTMENT OF AGRICULTURE

By /s/ J. B. Earle  
State Conservationist

Date 12/9/71





SUPPLEMENT NO. 2

to the

WATERSHED WORK PLAN AGREEMENT

between the

CAMERON PARISH GRAVITY DRAINAGE DISTRICT NO. 3  
Local Organization

CAMERON PARISH GRAVITY DRAINAGE DISTRICT NO. 4  
Local Organization

GULF COAST SOIL AND WATER CONSERVATION DISTRICT  
Local Organization

CAMERON PARISH POLICE JURY  
Local Organization

(hereinafter referred to as the Sponsoring Local Organizations)

State of Louisiana

and the

Soil Conservation Service  
United States Department of Agriculture  
(hereinafter referred to as the Service)

Whereas, the Watershed Work Plan Agreement for the Cameron-Creole Watershed, State of Louisiana, executed by the Sponsoring Local Organizations named therein and the Service, became effective on the 1st day of April, 1969; and

Whereas, in order to carry out the watershed work plan it became necessary to prepare a Supplemental Watershed Work Plan Agreement to make provisions for administering the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 - Public Law 91-646 (84 Stat. 1894); said Supplement becoming effective on the 9th day of December, 1971; and

Whereas, in order to carry out the watershed work plan it has become necessary to modify the Watershed Work Plan and to again modify the Watershed Work Plan Agreement, as supplemented; and



Whereas, a Supplemental Watershed Work Plan No. 2 which modifies the watershed work plan dated January, 1967, for said watershed has been developed through the cooperative efforts of the Sponsoring Local Organizations and the Service; which plan is annexed to and made a part of this agreement;

Now, therefore, the Sponsoring Local Organizations and the Service hereby agree upon the following modifications of the terms, conditions, and stipulations of said Watershed Work Plan Agreement, as supplemented:

1. Paragraph numbered 1 is modified to read as follows:

Except as hereinafter provided, the Sponsoring Local Organizations will acquire without cost to the federal government such land rights as will be needed in connection with the works of improvement (Estimated Cost \$202,900). The percentages of this cost to be borne by the Sponsoring Local Organizations and the Service as follows:

Works of Improvement	Sponsoring Local Organizations (Percent)	Service (Percent)	Estimated Land Rights Cost (Dollars)
Water Control Structures	100	0	200
Channel Improvement	100	0	170,700
Levee	100	0	<u>32,000</u>
Total			202,900

2. Paragraph numbered 3 is modified to read as follows:

The percentages of construction cost of structural measures to be paid by Gravity Drainage District No. 3, by Gravity Drainage District No. 4, and by the Service are as follows:





	District No. 3 (Percent)	District No. 4 (Percent)	Service (Percent)	Estimated Construction Cost (Dollars)
<b>MULTIPLE PURPOSE:</b>				
<u>Channel Improvement</u>				
W-1 (East and West)	14.7	10.3	75.0	122,566
W-2	25.0	0.0	75.0	5,771
W-4, W-5, W-6, W-7	0.0	25.0	75.0	232,363
<u>Water Control Structures</u>				
No. 1	12.5	12.5	75.0	250,300
No. 2	37.0	0.0	63.0	140,500
No. 3	25.0	0.0	75.0	11,000
<b>SINGLE PURPOSE:</b>				
<u>Water Control Structures</u>				
Nos. 4, 5, and 6	0.0	0.0	100.0	300,500
<u>Levee</u>				
<u>First Phase</u>				
Approximate Sta (-)16+40				
to 34+55	43.4	0.0	56.6	37,700
Remainder	0.0	0.0	100.0	634,100
Second and Third Phase	0.0	0.0	100.0	78,300

3. Paragraph numbered 4 is modified to read as follows:

The percentages of the engineering services to be borne by the Sponsoring Local Organizations and the Service are as follows:

Works of Improvement	Sponsoring Local Organizations (Percent)	Service (Percent)	Estimated Engineering Cost (Dollars)
Water Control Structures	0	100	45,500
Channel Improvement	0	100	25,200
Levee	0	100	<u>51,300</u>
Total			122,000



4. Paragraph numbered 5 is modified to read as follows:

The Gravity Drainage District No. 3 and No. 4 of Cameron Parish as Sponsoring Local Organizations and the Service will each bear the costs of Project Administration which it incurs, estimated to be \$9,000 and \$340,300 respectively.

The Sponsoring Local Organizations and the Service further agree to all other terms, conditions and stipulations of said Watershed Work Plan Agreement and Supplemental Work Plan Agreement not modified herein.



CAMERON PARISH GRAVITY DRAINAGE  
DISTRICT NO. 3

Local Organization

By /S/ J. A. Davis

Title President

Date 1/19/72

The signing of this agreement was authorized by a resolution of the governing body of the CAMERON PARISH GRAVITY DRAINAGE DISTRICT No. 3, adopted at a meeting held on 1/19/72.

/S/ E. J. Dronet

Secretary, Cameron Parish Gravity  
Drainage District No. 3

Date 1/19/72

-----  
CAMERON PARISH GRAVITY DRAINAGE  
DISTRICT NO. 4

Local Organization

By /S/ Joe P. Rutherford

Title President

Date 1/19/72

The signing of this agreement was authorized by a resolution of the governing body of the CAMERON PARISH GRAVITY DRAINAGE DISTRICT NO. 4, adopted at a meeting held on \_\_\_\_\_.

/S/ Dalton J. Richard

Secretary, Cameron Parish Gravity  
District No. 4

Date 1/20/72





GULF COAST SOIL AND WATER CONSERVATION  
DISTRICTLocal OrganizationBy /S/ Tom ThomasTitle ChairmanDate 1/13/72

The signing of this agreement was authorized by a resolution of the governing body of the GULF COAST SOIL AND WATER CONSERVATION DISTRICT, adopted at a meeting held on 1/13/72.

/S/ Raymond D. ReedsSecretary, Gulf Coast Soil and Water  
Conservation DistrictDate 1/13/72

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CAMERON PARISH POLICE JURYLocal OrganizationBy /S/ W. F. Henry, Jr.Title PresidentDate 2/3/72

The signing of this agreement was authorized by a resolution of the governing body of the CAMERON PARISH POLICE JURY, adopted at a meeting held on 1/31/72.

/S/ Jerry JonesSecretary, Cameron Parish Police JuryDate 2/3/72



Soil Conservation Service  
UNITED STATES DEPARTMENT OF AGRICULTURE

By /S/ J. B. Earle  
J. B. Earle, State Conservationist

Date 2/8/72





SUPPLEMENTAL WORK PLAN  
CAMERON-CREOLE WATERSHED, LOUISIANA

December, 1971

FOREWORD

The Cameron-Creole Watershed Work Plan became effective on April 1, 1969. A Supplemental Watershed Work Plan Agreement was executed on December 9, 1971 to make provisions for administering the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 - Public Law 91-646 (84 Stat. 1894).

In the course of reviews conducted in this watershed, it was determined that, should the levee be installed as planned, damages would be brought about by the restriction of the natural overbank flow of water and ingress and egress of fish, shrimp, crabs, and other organisms utilizing this area as a prime nursery ground.

Cooperatively, the Soil Conservation Service, the Louisiana Wild Life and Fisheries Commission, the Bureau of Sport Fisheries and Wildlife, and the Louisiana Department of Public Works studied the area to determine how to maintain as much of the existing water circulation pattern as possible without eliminating other benefits the levee is planned to produce. To achieve this end, it was determined that two additional structures should be constructed in the levee within the refuge and one additional structure should be constructed in the levee on private land.

The modified plan will not achieve the nutrient and organism exchange that now occurs with periodic sheet flooding by high tides from Calcasieu Lake. However, the Bureau of Sport Fisheries and Wildlife, the Louisiana Wild Life and Fisheries Commission, and the Soil Conservation Service believe that the addition of the three structures to the one proposed, tied together by the continuous borrow or back levee canal, will prove to be a good water circulation system. With the project as modified and the structures on the refuge operated by the Bureau of Sport Fisheries and Wildlife to serve project objectives, so long as primary purposes of the refuge are not endangered, the agencies named above believe the valuable waterfowl marsh and estuarine complex can be continued. This supplement provides for the inclusion of these three structures as part of the plan.

The Cameron Parish Gravity Drainage District No. 3 has requested a change in the location of Water Control Structure No. 2. Previously, this structure was planned to be approximately 300 feet north of the intersection



of the levee and Channel W-1 West. The drainage district has requested this structure be placed at the intersection of the levee and the channel. The relocating of this structure is for the convenience of the sponsoring local organizations. The increased cost made necessary by this change has been determined to be a non-project cost. This Supplement provides for this change.

#### Change in Major Features

Three additional water control structures will be installed to allow beneficial exchange of water and marine life to and from the marsh and estuarine areas. These are mitigation measures to reduce damages that would otherwise occur when the levee is built, and they will be installed in the following manner: (See Revised Project Map)

1. Water Control Structure No. 4 will be installed at Peconi Bayou. It will have a crest length of at least 30 feet at a fixed level 0.5 foot below mean marsh level. Manual gates, capable of being closed to exclude floodwater when Calcasieu Lake is high, will be installed above the crest. Operational responsibility will rest with Gravity Drainage District No. 3.
2. Water Control Structures No. 5 and 6 will be installed on land administered by the Bureau of Sport Fisheries and Wildlife as a part of the Sabine National Wildlife Refuge. They will be located at Lambert Bayou and Tripod Bayou. These structures will have a 30 foot crest length and the crest elevation will be variable to range from minus 4.0 feet mean sea level to plus 1.0 feet mean sea level. Manual gates, capable of being closed to exclude floodwater when Calcasieu Lake is high, will be installed. Operational responsibility will rest with the Bureau of Sport Fisheries and Wildlife.

The Cameron Parish Gravity Drainage District No. 3 will be responsible for administration of contracts and local interests in construction inspection on water control structures Nos. 4, 5, and 6.

#### Operation and Maintenance

Cameron Parish Gravity Drainage District No. 3 will have direct responsibility for operation and maintenance of water control structures Nos. 4, 5, and 6. The Bureau of Sport Fisheries and Wildlife has requested that they be assigned operation responsibility for water control structures Nos. 5 and 6, and the sponsors have agreed. The estimated annual cost of operation is \$2,000 based on adjusted normalized prices.



Water Control Structures Nos. 5 and 6 will have a variable crest control elevation. Optimum water levels to be maintained in the marsh is between 4 inches above to 2 inches below marsh level. Within this tolerance the structures will be operated to allow beneficial exchange of marine organisms and maintenance of desirable salinities. The variable crest weir may be operated at any desirable elevation between minus four feet and plus one foot mean sea level to accomplish the objective.

Flood gates on Water Control Structures Nos. 4, 5, and 6 will be closed when Calcasieu Lake rises, or it appears the rise is imminent, to a stage in excess of that considered desirable on the marsh.

The sponsoring local organizations fully understand their obligations for operation and maintenance agreement with the Soil Conservation Service prior to the execution of the project agreement for the installation of structural measures.

#### Change in Cost-Sharing Agreement

The Cameron Parish Gravity Drainage District No. 3 has requested that Water Control Structure No. 2 be moved approximately 300 feet southward along the centerline of the levee to the intersection of Channel W-1 West. This change is for the convenience of the Sponsors. The structure in its new location will be more costly, and the increased costs are non-project costs to be borne by the Sponsors. Cost-sharing arrangements are revised to produce the same cost in dollars to Public Law 566 with the structure relocated as would have been the case at the original location. No additional cost of engineering services are anticipated.

Since the three new water control structures are to be installed to mitigate damages caused by construction of the levee, the cost of these structures are allocated to flood prevention, the same purpose as the levee.

#### Revised Costs Reflected in this Supplement

Cost estimates shown in this Supplement reflect current prices. The price base is 1971.

The total cost of engineering services (\$122,000) includes the direct costs of work to be done by engineers and technicians in relation to structural measures. The work consists of surveys, investigations, designs, and preparation of plans and specifications including vegetative requirements. The cost of these services will be paid from Public Law 566 funds.

The Service and the Sponsoring Local Organizations will be responsible for the cost of items of project administration that each incurs. These





costs (estimated to be \$349,300) are the administrative costs associated with the installation of structural measures. The sponsors will bear costs for administration of contracts (\$8,000) and for such inspections (\$1,000) they believe necessary to insure themselves the work is being done in their interest. The Service will bear the costs of inspections that are necessary to protect the interests of the federal government and will prepare certificates of completion (estimated cost \$174,400). It will also bear the cost of government representatives and other project administration services it incurs (\$165,900).

The interest rate used for the evaluation of the original plan was 3 1/8 percent. In keeping with standard procedure as prescribed by Watersheds Memorandum-92 (Rev. 1), Supplement No. 2., this Supplement is prepared using an amortization rate of 3 1/4 percent.

Average annual primary benefits from structural measures are estimated to be \$168,732. The average annual cost of structural measures (amortized installation cost plus operation and maintenance cost) is estimated to be \$114,400, providing a benefit-cost ratio of 1.5 to 1.0. Total average annual benefits, including secondary benefits, from structural measures are estimated to be \$195,766, increasing the benefit-cost ratio to 1.7 to 1.0 (Table 6).

### Tables

Changes caused by this Supplement require revision of Tables 1, 2, 2A, 3A, 4 and 6. These revised tables are attached to this Supplement and made a part thereof.





Table 1 - ESTIMATED PROJECT INSTALLATION COST  
Cameron-Creole Watershed, Louisiana

	:	:	:	Estimated Cost (Dollars) <sup>1/</sup>		
	:	:	:	Public Law	Other	:
Installation Cost Item	:	Unit	: Number	: 566 Funds	: Funds	: Total
<u>LAND TREATMENT</u>						
Soil Conservation Service						
Cropland		Acres	600	-	19,300	19,300
Rangeland		Acres	22,000	-	139,300	139,300
Wildlife		Acres	40,000	-	22,000	22,000
Technical Assistance				37,620	15,910	53,530
Subtotal - SCS				37,620	196,510	234,130
TOTAL LAND TREATMENT				37,620	196,510	234,130
<u>STRUCTURAL MEASURES</u>						
<u>Construction</u>						
Soil Conservation Service						
Water Control Structures						
Nos. 1, 2, 3		Number	3	261,975	87,325	349,300 <sup>2/</sup>
Stream Channel Improvement		Miles	35	270,525	90,175	360,700
Levee		Miles	19	733,700	-	733,700 <sup>3/</sup>
Water Control Structures						
Nos. 4, 5, 6		Number	3	300,500	-	300,500
Subtotal - Construction				1,566,700	177,500	1,744,200
<u>Engineering</u>						
Soil Conservation Service						
Engineering Services				122,000	-	122,000
Subtotal - Engineering				122,000	-	122,000
<u>Project Administration</u>						
Soil Conservation Service						
Construction Inspection				174,400	1,000	175,400
Other				165,900	8,000	173,900
Subtotal - Administration				340,300	9,000	349,300
<u>Other Costs</u>						
Land Rights				-	202,900	202,900
Subtotal - Other Costs				-	202,900	202,900
TOTAL STRUCTURAL MEASURES				2,029,000	389,400	2,418,400
TOTAL PROJECT				2,066,620	585,910	2,652,530

<sup>1/</sup>Price base: 1971

<sup>2/</sup>Does not include \$16,500 non-project cost for  
Water Control Structure No. 2

<sup>3/</sup>Does not include \$16,400 non-project cost.

Supplement No. 2  
December, 1971



TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION

Cameron-Creole Watershed, Louisiana  
(Dollars)<sup>1/</sup>

Item	Installation Cost - P.L. 566 Funds			Installation Cost - Other Funds			Total		
	Construction	Engineering	Total Public	Construction	Rights	Land	Other	Installation	Cost
Multiple-Purpose									
Water Control Structures Nos. 1 and 3	195,975	18,300	214,275	65,325	200		65,525	279,800	
Water Control Structure No. 2	66,000	6,200	72,200	22,000	-		22,000	94,200	
(Non-Project)	-	-	-	(16,500) <sup>2/</sup>	-		(16,500) <sup>2/</sup>	(16,500) <sup>2/</sup>	
Channel Improvement	270,525	25,200	295,725	90,175	170,700		260,875	556,600	
Single-Purpose									
Levee	733,700	51,300	785,000	-	32,000		32,000	817,000	
(Non-Project)	-	-	-	(14,200)	(2,200)		(16,400)	(16,400)	
Water Control Structures Nos. 4, 5, and 6	300,500	21,000	321,500	-	-		-	321,500	
Subtotal	1,566,700	122,000	1,688,700	177,500	202,900		380,400	2,069,100	
Project Administration	-	-	340,300	-	-		9,000	349,300	
GRAND TOTAL	1,566,700	122,000	2,029,000	177,500	202,900		389,400	2,418,400	

<sup>1/</sup> Price base: 1971

<sup>2/</sup> Non-Project Cost - Changed location of Water Control Structure No. 2 for convenience of the sponsors

Supplement No. 2  
December, 1971







TABLE 3A - STRUCTURE DATA

WATER CONTROL STRUCTURES

Cameron-Creole Watershed, Louisiana

Structure Number	Type of Structure	Drainage Area (acres)	Design Capacity (cfs)	Concrete Volume (cu yds)	Conduit Diameter (inches)	Conduit Length (ft)	Inside Water Surface Elevation (ft msl)	Elevation : Top of Outside Gate (ft msl)	Weir Crest Length (ft)
1	Two Way Semi-Automatic	50,520	708	232	-	-	1.0	5.0	50
2	Drop Inlet with Flap Gate	6,700	76	-	-	-	0.0	-	-
3	Drop Inlet with Conduit and Flap Gate	2,020	26	-	1-36"	50	1.0	-	-
4	Fixed Crest Weir with Floodgates	-	-	70	-	-	1/	5.0	30
5	Variable Crest Weir with Floodgates	-	-	125	-	-	1.0	5.0	30
6	Variable Crest Weir with Floodgates	-	-	125	-	-	1.0	5.0	30

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December, 1971

1/ Crest at 0.5 feet below mean marsh level





Table 4 - ANNUAL COST

Cameron-Creole Watershed, Louisiana  
(Dollars)<sup>1/</sup>

Evaluation Unit	: Amortization of : Installation Cost <sup>2/</sup>	: Operation and : Maintenance Cost	:	Total
Water Control Structures, Levee, and Channel Improvement	84,300	15,900		100,200
Project Administration	14,200			14,200
TOTAL	98,500	15,900		114,400

<sup>1/</sup>Price base: Installation Cost 1971, O&M adjusted normalized prices

<sup>2/</sup>Amortized for 50 years at 3.250 percent interest

Supplement No. 2  
December, 1971



TABLE 6 - COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES

Cameron-Creole Watershed, Louisiana  
(Dollars)

Evaluation Unit	Average Annual Benefits <sup>1/</sup>				Average Annual Cost <sup>2/</sup>		Benefit : Cost Ratio
	Damage Reduction	More Intensive : Land Use	Incidental : Wildlife	Secondary	Total	Annual Cost	
Water Control Structures, Levee, and Channel Improvement	66,599	6,002	60,020	36,111	27,034	195,766	2.0:1
Project Administration						14,200	
TOTAL	66,599	6,002	60,020	36,111	27,034	195,766	1.7:1

<sup>1/</sup> Adjusted normalized prices

<sup>2/</sup> From Table 4

Supplement No. 2  
December, 1971



WATERSHED WORK PLAN AGREEMENT

between the

CAMERON PARISH GRAVITY DRAINAGE DISTRICT NO. 3  
Local Organization

CAMERON PARISH GRAVITY DRAINAGE DISTRICT NO. 4  
Local Organization

GULF COAST SOIL AND WATER CONSERVATION DISTRICT  
Local Organization

CAMERON PARISH POLICE JURY  
Local Organization

(hereinafter referred to as the Sponsoring Local Organizations)

State of Louisiana

and the

Soil Conservation Service  
United States Department of Agriculture  
(hereinafter referred to as the Service)

Whereas, application has heretofore been made to the Secretary of Agriculture by the Sponsoring Local Organizations for assistance in preparing a plan for works of improvement for the CAMERON-CREOLE WATERSHED, State of Louisiana, under the authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83d Congress; 68 Stat. 666), as amended; and

Whereas, the responsibility for administration of the Watershed Protection and Flood Prevention Act, as amended, has been assigned by the Secretary of Agriculture to the Service; and

Whereas, there has been developed through the cooperative efforts of the Sponsoring Local Organizations and the Service a mutually satisfactory plan for works of improvement for the CAMERON-CREOLE WATERSHED, State of Louisiana, hereinafter referred to as the watershed work plan, which plan is annexed to and made a part of this agreement;

Now, therefore, in view of the foregoing considerations, the Sponsoring Local Organizations and the Secretary of Agriculture, through the Service, hereby agree on the watershed work plan, and further agree that the works of improvement as set forth in said plan can be installed in about five years.



It is mutually agreed that in installing and operating and maintaining the works of improvement substantially in accordance with the terms, conditions, and stipulations provided for in the watershed work plan:

1. The Sponsoring Local Organizations will acquire without cost to the Federal Government such land, easements, or rights-of-way as will be needed in connection with the works of improvement. (Estimated cost \$216,325.)
2. The Sponsoring Local Organizations will acquire, or provide assurance that landowners or water users have acquired, such water rights pursuant to State law as may be needed in the installation and operation of works of improvement.
3. The percentages of construction costs of structural measures to be paid by Gravity Drainage District No. 3, by Gravity Drainage District No. 4, and by the Service are as follows:

Measure	: District : : No. 3 : No. 4 : Service : (percent)(percent)(percent)	: Estimated : Construction : Cost (dollars)
Channel Improvement		
W-1 (East and West)	14.7 10.3 75.0	133,704
W-2	25.0 0.0 75.0	6,300
W-4, W-5, W-6, W-7	0.0 25.0 75.0	253,476
Water Control Structure		
No. 1	12.5 12.5 75.0	271,200
No. 2 and 3	25.0 0.0 75.0	58,800
Levee		
First Contract		
Approximate Sta. (-)40+60 to 65+00	43.4 0.0 56.6	73,800
Remainder	0.0 0.0 100.0	428,218
Second and Third Contract	0.0 0.0 100.0	85,562

4. The percentages of the cost for installation services to be borne by the Sponsoring Local Organizations and the Service are as follows:

Works of Improvement	Sponsoring Local Organizations (percent)	Service (percent)	Estimated Installation Service Cost (dollars)
Water Control Structures	0	100	114,584
Stream Channel Improvement	0	100	136,626
Levee	0	100	192,917





5. The Gravity Drainage Districts No. 3 and No. 4 of Cameron Parish will bear the costs of administering contracts. (Estimated cost \$8,000.)
6. The Gulf Coast Soil and Water Conservation District will provide assistance to landowners and operators to assure the installation of the land treatment measures shown in the watershed work plan.
7. The Sponsoring Local Organizations will encourage landowners and operators to operate and maintain the land treatment measures for the protection and improvement of the watershed.
8. The Sponsoring Local Organizations will be responsible for the operation and maintenance of the structural works of improvement by actually performing the work or arranging for such work in accordance with agreements to be entered into prior to issuing invitations to bid for construction work.
9. The costs shown in this agreement represent preliminary estimates. In finally determining the costs to be borne by the parties hereto, the actual costs incurred in the installation of works of improvement will be used.
10. This agreement does not constitute a financial document to serve as a basis for the obligation of Federal funds, and financial and other assistance to be furnished by the Service in carrying out the watershed work plan is contingent on the appropriation of funds for this purpose.

Where there is a Federal contribution to the construction cost of works of improvement, a separate agreement in connection with each construction contract will be entered into between the Service and the Sponsoring Local Organizations prior to the issuance of the invitation to bid. Such agreement will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.

11. The watershed work plan may be amended or revised, and this agreement may be modified or terminated, only by mutual agreement of the parties hereto.
12. No member of or delegate to Congress, or resident commissioner, shall be admitted to any share or part of this agreement, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.
13. The program conducted will be in compliance with all requirements respecting nondiscrimination as contained in the Civil Rights Act of 1964 and the regulations of the Secretary of Agriculture (7 C.F.R.



Sec. 15.1-15.13), which provide that no person in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any activity receiving Federal financial assistance.

CAMERON PARISH GRAVITY DRAINAGE

DISTRICT NO. 3

Local Organization

By J. A. Davis  
(J. A. Davis)  
Title Pres.  
(President)

Date July 6, 1967

The signing of this agreement was authorized by a resolution of the governing body of the CAMERON PARISH GRAVITY DRAINAGE DISTRICT NO. 3 adopted at a meeting held on July 6, 1967 Local Organization.

E. J. Dronet  
(E. J. Dronet)  
Secretary, Cameron Parish Gravity  
Drainage District No. 3

Date July 6, 1967

CAMERON PARISH GRAVITY DRAINAGE

DISTRICT NO. 4

Local Organization

By Joe P. Rutherford  
(Joe P. Rutherford)  
Title President  
(President)

Date July 6, 1967

The signing of this agreement was authorized by a resolution of the governing body of the CAMERON PARISH GRAVITY DRAINAGE DISTRICT NO. 4 adopted at a meeting held on June 22, 1967 Local Organization.



Dalton Richard

(Dalton Richard)

Secretary, Cameron Parish Gravity  
Drainage District No. 4

Date July 6, 1967

GULF COAST SOIL AND WATER CONSERVATION  
DISTRICT

Local Organization

By Tom Thomas  
(Tom Thomas)

Title Chairman  
(Chairman)

Date July 6, 1967

The signing of this agreement was authorized by a resolution of the governing  
body of the GULF COAST SOIL AND WATER CONSERVATION DISTRICT adopted at a

Local Organization

meeting held on June 8, 1967.

R. O. Hackett

(R. O. Hackett)

Secretary, Gulf Coast Soil and Water  
Conservation District

Date July 6, 1967

CAMERON PARISH POLICE JURY

Local Organization

By W. F. Henry, Jr.  
(W. F. Henry, Jr.)

Title Pres  
(President)

Date July 6, 1967



The signing of this agreement was authorized by a resolution of the governing body of the CAMERON PARISH POLICE JURY adopted at a meeting held on

Local Organization

July 3, 1967.

Jerry G. Jones  
(Jerry G. Jones)  
Secretary, Cameron Parish Police Jury  
Date July 6, 1967

Soil Conservation Service  
UNITED STATES DEPARTMENT OF AGRICULTURE

By \_\_\_\_\_

Date \_\_\_\_\_





WORK PLAN  
FOR  
WATERSHED PROTECTION, FLOOD PREVENTION  
AND  
AGRICULTURAL WATER MANAGEMENT

CAMERON-CREOLE WATERSHED

Cameron Parish, Louisiana

Prepared under the Authority of the Watershed  
Protection and Flood Prevention Act, (Public  
Law 566, 83d Congress, 68 Stat. 666), as  
amended

Prepared by:

Cameron Parish Gravity Drainage District No. 3  
(Sponsor)

Cameron Parish Gravity Drainage District No. 4  
(Sponsor)

Gulf Coast Soil and Water Conservation District  
(Sponsor)

Cameron Parish Police Jury  
(Sponsor)

With Assistance by:

✓ the  
Louisiana, ✓ Department of Public Works,

the  
United States Department of Interior  
Fish and Wildlife Service  
Division of Refuges  
U.S. Bureau of Sport Fisheries and Wildlife

and the

United States Department of Agriculture  
✓ Soil Conservation Service



## WATERSHED WORK PLAN

### CAMERON-CREOLE WATERSHED

Cameron Parish, Louisiana

January 1967

#### SUMMARY OF PLAN

This work plan is for watershed protection, flood prevention, and agricultural water management in the Cameron-Creole Watershed. It was prepared by the Gravity Drainage District No. 3 and Gravity Drainage District No. 4 of Cameron Parish, the Cameron Parish Police Jury, and the Gulf Coast Soil and Water Conservation District as the sponsoring local organizations. Technical assistance was provided by the Department of Public Works of the State of Louisiana, the Bureau of Sport Fisheries and Wildlife of the U. S. Department of Interior, and the Soil Conservation Service of the U. S. Department of Agriculture.

The watershed contains about 113,000 acres, or 177 square miles, in Cameron Parish. Approximately 1 percent of the area is in cropland, 8 percent is in pastureland, 68 percent is in rangeland, and 23 percent is in miscellaneous uses which include the national wildlife refuge, villages, farmsteads, roads, etc. The Bureau of Sport Fisheries and Wildlife administers 14,926 acres, and the Cameron Parish School Board administers about 1,280 acres. The remainder of the area is privately owned.

All of the watershed land is level to nearly level. The elevations range from sea level to 8 feet above sea level. All land below the approximate elevation of 2 feet above sea level is considered marsh and approximately 82 percent of the watershed is in this category. Land that is above this elevation consists of several ridges, locally referred to as "chenieres," and practically all the watershed residents have their homes on these chenieres.

Cameron (population about 2,700) and Creole (population about 100) are the only villages in the watershed.

There are both saltwater marshes and freshwater marshes within the watershed, and both are highly productive range sites for grazing cattle and for wildlife habitat. The natural vegetation that is desirable as forage plants for cattle produces from 2,000 pounds of air-dry herbage per acre up to 10,000 pounds. This marsh area is centered in one of the major duck and geese wintering areas of the United States.

This area has deteriorated as a wetland marsh since the mid-1940's, due to increasing soil and water salinities, undesirable fluctuation of low water levels, and extremely high floodwater inundation. These conditions alternately occur. Flooding of the marsh occurs from storm runoff in the Calcasieu River watershed, from abnormally high tide events, and from high direct precipitation. It is estimated that the carrying capacity of the



range has been reduced by 3,500 to 4,000 head of livestock during the last 10 years.

The primary objectives of the project are watershed protection, flood prevention, and water management for range. The proposed plan will meet these objectives by installing, in a 5-year period, a project for the protection and development of the watershed. The total estimated installation cost is \$2,181,662. Public Law 566 will bear \$1,579,957 (or about 72 percent) of this total, and the remaining \$601,705 (or about 28 percent) will be borne by other funds. Other interests will bear the entire cost of operation and maintenance.

### Land Treatment Measures

Approximately 35 percent of all needed land treatment measures which remain to be installed for watershed protection and improvement will have been installed by the end of the 5-year installation period. The cost of these measures is estimated to be \$234,130, of which \$180,600 is for the cost of installing the practices and includes expected reimbursement from the Agricultural Stabilization and Conservation Service. The remaining \$53,530 is for technical assistance and includes \$15,910 presently being provided by the going programs and \$37,620 needed to accelerate the installation period.

Land treatment needed for watershed protection, flood prevention, and water management which is expected to be installed during the project period is shown in table 1.

### Structural Measures

Structural measures planned consist of about 19 miles of single-purpose levee for flood prevention, 35 miles of multiple-purpose channel improvement for flood prevention and agricultural water management, and 3 multiple-purpose water control structures for flood prevention and agricultural water management. The total cost of structural measures is estimated to be \$1,947,532, of which Public Law 566 will bear \$1,542,337. The remaining \$405,195 will be borne by other funds and includes \$180,870 for construction; \$216,325 for land, easements and rights-of-way; and \$8,000 for contract administration.

### Benefits

Approximately 2,500 persons live within the watershed and will receive benefits from the installation of the project. Benefits will result directly to about 98,074 acres involving about 295 landowners and operators and to 14,926 acres of the Sabine National Wildlife Refuge administered by the Bureau of Sport Fisheries and Wildlife. The average annual benefits accruing to structural measures are estimated to be \$195,766. The average annual cost of these measures is estimated to be \$92,238, which produces a benefit-cost ratio of 2.1 to 1.





### Operation and Maintenance

Land treatment measures will be maintained by the landowners and operators of the farms on which the measures are installed. The Gulf Coast Soil and Water Conservation District will furnish technical assistance for the operation and maintenance of these measures.

The Bureau of Sport Fisheries and Wildlife, which administers 14,926 acres within the watershed as a national wildlife refuge, has requested that they be assigned operation responsibility of Water Control Structure No. 1 which is located on the refuge. The two gravity drainage districts will be responsible for maintenance of all structural measures including those on the national wildlife refuge and will be responsible for operation of Water Control Structures Nos. 2 and 3. Two existing water control structures will continue to be operated by the gravity drainage districts. The estimated annual operation and maintenance cost is \$14,746 based on adjusted normalized prices.

### Provisions for Financing Project Installation

The Louisiana Department of Public Works has agreed to assist in the sharing of the local cost of these measures contingent on the appropriation of funds for this purpose by the Louisiana legislature. However, the local residents recognize that additional funds will be necessary. Local leadership is available and has recognized the need for assessment of a tax to provide the local share of the cost of installation of structural measures.

A project agreement will be entered into between the gravity drainage districts and the Soil Conservation Service to include the commitments by both parties.

### DESCRIPTION OF THE WATERSHED

#### Physical Data

Cameron-Creole Watershed is located in the extreme southwestern portion of Louisiana in Cameron Parish. The city of Lake Charles lies approximately 25 miles to the north. This watershed is bounded on the south by the Mermentau River and the Gulf of Mexico; on the west by Calcasieu Pass and Calcasieu Lake; on the north by the Intracoastal Waterway; and on the east by Louisiana Highway No. 27, Little Cheniere Ridge, and Little Cheniere Canal. There are about 113,000 acres, or 177 square miles, within the area.

The elevation of the land varies from sea level to a maximum of 8 feet above sea level. The topography is so flat that a distinct drainage pattern does not exist. Generally, the drainage of the western half is from east to west and outlets into Calcasieu Pass or Calcasieu Lake and the eastern half drains to the east and south into the Mermentau River.

The Calcasieu River drains approximately 2,500 square miles of land area in southwest Louisiana. This river outlets into Calcasieu Lake which in turn outlets through the Calcasieu Pass into the Gulf of Mexico. The Calcasieu





Ship Channel is a deep water channel that has been constructed from the Gulf through Calcasieu Pass, Calcasieu Lake, and the Calcasieu River as far upstream as the city of Lake Charles.

Calcasieu Lake is a large inland body of water encompassing approximately 175 square miles of surface area. This lake forms a large portion of the western boundary of the watershed.

Cameron (population about 2,700) and Creole (population about 100) are the only villages within the area. Several ridges, locally referred to as "chenieres," provide the only land of sufficient elevation for residences. Practically all of the estimated 2,500 persons residing within the watershed have their homes on these chenieres. The population has remained fairly constant during the last 10 years.

The watershed is within the Gulf Coast Marsh Land Resource Area. The most northerly boundary is in an area of Pleistocene deposits of the Prairie formation. This formation is overlain elsewhere in the area by Recent Deltaic Plain Deposits. The oxidation of the Prairie formation, which in some instances is overlain by 40 or more feet of Recent deposits, reflects a combination of the rise in sea level and the subsidence of the coastal area.

Gas and oil are the only commercial mineral resources of the area.

The annual rainfall is about 58 inches. It is usually well distributed throughout the year. October is the driest month with an average rainfall of 3.1 inches, and July is the wettest with an average of 7.3 inches. The minimum recorded rainfall within a given year is 28.7 inches and the maximum is 80.1 inches. Mean monthly temperatures range from a high of 82° Fahrenheit in July to a low of 54° in January.

Water for human consumption is obtained from deep wells and from cisterns. Livestock water and water for industrial use is obtained from deep wells and from natural bayous and channels. These sources are considered adequate.

A portion of the Sabine National Wildlife Refuge (14,926 acres) is within the watershed. This refuge is administered by the Bureau of Sport Fisheries and Wildlife. The principal management objectives embrace protection of waterfowl populations and preservation and improvement of their wintering habitats. The refuge particularly is important as a wintering ground for blue and snow geese. Other primary objectives include: provisions for meeting habitat requirements of the mottled duck, blue-winged teal, and shore and waterbirds; protection of migratory birds other than waterfowl; and preservation of wetland habitat. Preservation of indigenous wildlife associated with wetlands, including alligators and various furbearers, and provision in designated areas for public enjoyment of migratory birds and other fish and wildlife resources are secondary objectives.

Grand Bayou, which outlets into Calcasieu Lake from the refuge, is an ingress and egress route to the important nursery area for menhaden, anchovies, and brown and white shrimp.



In addition to the wildlife refuge, much of the privately owned marsh land is valuable wetland-wildlife habitat; and the same wildlife found within the refuge is prevalent on the privately owned areas. Little habitat potential exists for upland-game species, although a few deer, doves, rabbits, and quail exist in the watershed.

The Cameron Parish School Board owns about 1,280 acres within the watershed. With the exception of the land administered by the Bureau of Sport Fisheries and Wildlife, all land is privately owned.

The estimated present land use in the watershed is: cropland, 1 percent; pastureland, 8 percent; rangeland, 68 percent; and 23 percent is in miscellaneous uses which include the national wildlife refuge, villages, farmsteads, roads, etc.

#### Economic Data

The agricultural economy of the watershed is based primarily upon beef cattle production. Rice is produced on a very small acreage and provides a limited amount of income. The average value of sales of livestock and farm products amounted to \$3,086 per farm in Cameron Parish in 1959.

The agricultural income is based almost entirely on beef cattle which is produced on marsh range land. There are both saltwater marshes and freshwater marshes within the watershed, and both are highly productive range sites for grazing. Natural vegetation that is desirable as forage plants includes Olney bulrush, Smooth cordgrass, Gulf cordgrass, and Marshhay cordgrass. The production from these plants varies by sites from 2,000 pounds of air-dry herbage per acre up to 10,000 pounds.

In 1955 there were 55,000 head of cattle in Cameron Parish. In 1957, "Hurricane Audrey" devastated a large portion of southwest Louisiana, and this watershed was in the area that suffered greatest damages. Many persons lost their lives, and damage to livestock and property was immense. In 1959, the time of the next close count following the hurricane, there were only 27,000 cattle in the parish. This reduction was attributable to the high mortality rate occurring during the storm and to the reduced grazeable marsh acreage brought about primarily by the storm. A rebuilding program increased the number of cattle in the parish to 36,000 by 1964. Data which is available for the parish is considered representative for the watershed.

There are about 295 farms or farm units in the watershed and nearly all of them produce livestock as the main enterprise. The average size farm is about 225 acres with a value of about \$36,500 for land and buildings. Practically all of the farms are owner-operated.

Other income is derived from production of gas and oil, both within the watershed and in the offshore areas; from hunting, fishing, and trapping; and from providing services to seagoing vessels. Menhaden is a small fish of the herring family that is caught in abundance in the Gulf waters near





Cameron. Oil for precision tools is extracted from these fish. The by-product, called "fish meal," is used as a component in fertilizer and poultry feed. There are two plants for processing these fish in Cameron and a third is now under construction.

An adequate system of roads serves the area to allow transportation and travel. Several trucklines furnish regular transportation. Barge loading and unloading facilities are located at Cameron.

#### Land Treatment Data

The 295 farms are served by the Gulf Coast Soil and Water Conservation District. Technical assistance is provided by the Soil Conservation Service work unit at Lake Charles and sub-work unit at Cameron. These work units have assisted in the preparation of 149 conservation plans on about 75,800 acres. Of this number, 111 plans covering about 72,000 acres are basic conservation plans. This represents about 64 percent of the watershed.

About 50 percent of the planned land treatment measures have been installed. A summary of the land treatment measures that have been installed during the last 10 years is shown in table 1A. Cost of installing these measures is estimated to be \$552,260.

#### WATERSHED PROBLEMS

The primary grasses that are desirable for range forage and wildlife food and cover that are present in this watershed are Longtom, Seashore paspalum, Seashore saltgrass, Gulf cordgrass, Marshhay cordgrass, Three-square grass, Bulrush, Coast cockspur, Barnyardgrass, Smartweed, Paille fine, Sprangletop, Widgeongrass, and Giant-cutgrass. For maximum growth of these grasses and their utilization by livestock, water and salinity levels must be maintained as near optimum as possible.

This area has deteriorated as a wetland marsh since the mid-1940's due to increasing soil and water salinities, undesirable fluctuation of low water levels, and extremely high floodwater inundation.

#### Floodwater Problems

Flooding of the marsh occurs from four sources: (1) storm runoff in the Calcasieu River watershed, (2) salt ocean water during periods of abnormally high wind and/or lunar tides in the Gulf of Mexico, (3) wind tides occurring on Calcasieu Lake, and (4) high direct precipitation.

Calcasieu Lake forms a large portion of the western boundary of the watershed, and the land within the area that drains into this lake is low -- at least 60 percent being less than 1.5 feet above mean sea level. During periods of high rainfall in the Calcasieu River watershed, the lake rises due to the inability of Calcasieu Pass to discharge the water rapidly enough into the Gulf of Mexico. As the lake stage increases, sheet flooding of the low marshland occurs.



During high lunar and/or wind tides, water from the Gulf flows into Calcasieu Lake through Calcasieu Pass. The construction of the Calcasieu Ship Channel has increased the effect of Gulf tides on the lake. Land within the Cameron-Creole Watershed is flooded by sheet passage of water when these abnormal events occur. Creole Canal and King's Bayou, which also drain portions of the watershed, outlet into the Mermentau River and abnormally high tidal events cause floodwater to enter the watershed through these waterways.

During periods of prolonged northerly or westerly wind events in conjunction with high Gulf tides, the narrow outlet for Calcasieu Lake cannot remove water as fast as the wind tide on the lake builds up. Sheet flooding of the marsh range and wildlife habitat areas occurs as the lake stage increases.

Flooding also occurs from high direct precipitation. On the average, a rainfall of at least 2.8 inches in a 24-hour period is expected to occur twice a year; 4.2 inches is expected to occur once a year; and 7.4 inches once in 5 years. Several chenieres within the watershed do not suffer floodwater damage from direct precipitation; however, runoff from these areas contributes to flooding of lower lying areas.

The source of damaging floodwater may be salt Gulf water or storm runoff from the Calcasieu River watershed. Each type of floodwater, in addition to causing damage from prolonged inundation, adversely affects the growth of desirable vegetation in the marsh. Desirable vegetation that is tolerant to fresh water is damaged to a high degree when inundated by salt water; likewise, vegetation that tolerates salt water is greatly damaged when flooded by excessive amounts of fresh water. These more desirable types of vegetation are being replaced by less desirable vegetation that is tolerant to both fresh and salt water. In many areas large spaces develop that are void of vegetation of any type. It is estimated by local land-owners, operators, and agricultural workers that the stocking rates of the marsh range have been reduced by 3,500 to 4,000 head of livestock during the last 10 years.

Flooding of the marsh areas causes landowners and operators to restrict their stocking rate and move their livestock to the ridges or uplands outside the watershed. Losses in the form of additional feeding, moving livestock, weight loss, and increased mortality in the herds are associated with the flooding.

Excessive flooding of the marsh, and particularly the alternate flooding by fresh and salt water, is damaging to wildlife habitat. Local channels are becoming so filled with sediment that small boat traffic is impossible during periods of low tide. Floodwater is the primary cause of moving sediment into these channels. These channels are used by the Bureau of Sport Fisheries and Wildlife in management of the refuge, and also by fishermen, trappers, and hunters outside the refuge.

#### Problems Relating to Agricultural Water Management

Optimum conditions for the production and utilization of most vegetation in the marsh for range and wildlife is a range of 2 inches below to 4 inches above the land surface. Normal tidal fluctuation produces a larger





range of water levels, and management of the area within its maximum capabilities is not possible.

During periods of extended drought, which often is intensified by low tides and northerly and easterly winds, extremely low water occurs in Calcasieu Lake and the marsh dries from excessive drainage to a point that is detrimental to the desirable vegetation. In this area, where the elevation of 75 percent of the area varies less than 1 foot, a normal tide causes a vast change on water conditions over a large portion of the marsh.

These drying conditions are detrimental to the marsh from a grazing standpoint. Desirable vegetation dies out and, until the water level again becomes stable for an extended period at or near the optimum level, cannot become re-established.

About 8,500 acres of marsh are now producing a low quality vegetation. This area is increasing each year. A reduction in the range and wildlife productivity of the area has been brought about by the inability to control water levels and salinities in the marsh areas.

From time to time landowners or groups of landowners have installed certain measures or groups of measures which (due to the partial nature of their approach) have not been effective in relieving the overall problem.

#### Erosion Damages

The Calcasieu Lake shoreline is eroding from continuous wave action. Comparison of aerial photographs that were taken over a period of 17 years indicates a shoreline erosion rate of approximately 10 feet per year. This figure substantiates the erosion rate of this shoreline as determined earlier by a cooperative study made by Louisiana State University's Coastal Studies Institute.

Soil erosion in the watershed is not considered serious.

#### Sediment Damage

Two sources of sediment are dominant in the watershed. The first source is derived from sheet erosion and is minor, providing negligible sediment damage. Regular channel maintenance of artificial channels is sufficient to remove this accumulation. The second source is from the large accumulation of silt and organic material on the bed of Calcasieu Lake. This provides appreciable sediment damage to the natural waterways. During storm periods, wave action disturbs this silt and organic accumulation and floodwaters entering the watershed transport this material into the natural waterways and deposit it in silt bars. These silt bars present an obstacle to small boat traffic during periods of low water.

#### PROJECTS OF OTHER AGENCIES

A portion of the Intracoastal Waterway, which extends from Florida to Brownsville, Texas, forms about 6 miles of the northern boundary of the



watershed. Floodwater from Calcasieu Lake is prevented from entering the Intracoastal Waterway by a series of navigational locks. A ship channel has been constructed from the Gulf of Mexico through Calcasieu Pass, Calcasieu Lake, and the Calcasieu River to the city of Lake Charles to provide a deep water port to that city. Each of these projects was constructed by the U. S. Corps of Engineers. No works of improvement planned in this work plan will have any adverse effects on either of these projects.

The Louisiana Department of Public Works, in cooperation with the Cameron Parish Gravity Drainage District No. 4, has constructed water control structures within this watershed on Creole Canal (see Channel W-6, Project Map) and King's Bayou (see Channel W-7, Project Map). These water control structures will enhance this watershed work plan, and an operation and maintenance agreement will be entered into to operate and maintain these structures in a manner that is compatible with the works of improvement proposed in this plan.

The Cameron Parish Gravity Drainage Districts No. 3 and No. 4 have each improved certain channels within this watershed. These channels will be further improved as part of this plan, and previous work will be integrated harmoniously.

The Louisiana Department of Public Works has constructed a sheet metal weir across North Prong of Grand Bayou immediately north of the northern boundary of the Sabine National Wildlife Refuge. The purpose of this weir is to prevent excessive drainage of the marsh area above the weir from tidal fluctuation. The works of improvement proposed in this plan will enhance the operation of this weir.

#### BASIS FOR PROJECT FORMULATION

The sponsors requested that consideration be given to all measures needed for adequate watershed protection, flood prevention, saltwater intrusion, and water level control. They are aware of the need for a level of protection which will allow production of beef cattle and supplemental management of wildlife resources to a degree commensurate with other limiting factors.

Project objectives are to provide measures necessary to protect and improve the marsh areas within the watershed to allow establishment and maintenance of desirable vegetation and to allow its utilization. The trend in this area is to utilize the marsh area to its fullest extent for the production of beef cattle and wildlife and fish. The exclusion of floodwater originating outside the watershed; the timely removal of floodwater originating inside the watershed; the prevention of excessive low water levels within the area; and the fluctuation of water levels and salinities within limits and the timely exchange of marine forms are necessary to accomplish these objectives.

A desirable control of minimum water levels is one which will prevent open ponds from drying out, maintain moist soil conditions in the marsh, and permit controlled fluctuation of water levels. Salt water should not be excluded from the area completely. Introduction of outside water into the





watershed through water control structures is desirable when the levels in the marsh drop below the minimum desirable or when it is necessary to maintain the salinity regimes desired.

The Grand Bayou system is an important nursery area for menhaden, anchovies, and shrimp. Water control structures should be designed in such a manner that they may be operated to allow timely exchange of these marine species.

Channel improvement necessary to provide a 3- to 5-year level of protection to the cropland and pasture on the chenieres is desirable. Rural homes are located on the highest points on these chenieres. Flooding of these homes occurs during storm events of extremely high intensity. Tropical hurricanes cause flooding to these homes, but protection from this type event is not considered within the scope of this project.

Determination was made of the land treatment measures which contribute directly to watershed protection, flood prevention, and agricultural water management. These determinations were made from land capability classes based on soil surveys and marsh range condition class based on field surveys by range conservationists of the Soil Conservation Service.

Although significant beneficial effects would result from installation of land treatment measures, it was apparent that structural measures would be required to attain the degree of protection desired. Based on completed field investigations and surveys, it was determined that improved channels operating in conjunction with water control structures would provide the most effective and economical means for removal of storm runoff and excess water from on-farm drainage systems and from other low lying areas.

In order to provide protection from floodwater originating outside the watershed, a levee will be constructed commencing at the cheniere immediately west of the village of Cameron and extending in a generally northerly direction along the eastern edge of Calcasieu Lake to a point near Jubert Point where the elevation of the natural ground surface is the same as the top of the Cameron Cheniere (approximately 5 feet above mean sea level).

Three water control structures will be installed to provide for removal of excess water, to control minimum water levels, and to allow controlled fluctuation of water. Two existing water control structures will be operated in a manner to provide the stated project objectives.

#### WORKS OF IMPROVEMENT TO BE INSTALLED

##### Land Treatment Measures

An effective conservation program based upon the use of each acre of agricultural land within its capabilities and its treatment in accordance with its needs for present and future production is necessary for a sound watershed program. Such a conservation program is now being carried out



by the Gulf Coast Soil and Water Conservation District. Basic to the attainment of these objectives is the establishment and maintenance of all applicable soil and water conservation measures essential to proper land use. Emphasis will be placed on accelerating the establishment of land treatment practices which have a measurable effect on the reduction of floodwater, sediment and erosion, and agricultural water management problems.

The land treatment measures which have been applied within the watershed during the last 10 years represent an expenditure of approximately \$552,260.

Table 1 includes estimates of the acreages in each major land use which will receive accelerated land treatment during the 5-year project installation period. These measures will be established and maintained by the landowners and operators in cooperation with the going district programs. In addition to the presently available technical assistance, Public Law 566 funds will be made available to accelerate the establishment of these practices and measures.

During the 5-year project installation period, it is expected that about 40,000 acres of wildlife wetland habitat areas will be improved.

Improved utilization of about 60,000 acres of marsh range will be realized through the installation of an additional 10 miles of cattle walkways, controlled burning, and deferred grazing. Facilities necessary for the proper removal of excessive runoff from the farms will be installed. Agricultural water management in the marsh areas will be facilitated by the installation of about five miles of dikes and levees and two pumping facilities.

Vegetative conditions will be improved and erosion reduced on the ridges through the renovation and proper management of about 2,000 acres of pasture and hayland.

Installation of the land treatment measures will reduce sheet erosion within the watershed. Permanent-type land treatment measures will reduce flooding, increase the efficiency of on-farm drainage, and assure landowners and operators of sustained productivity at reduced costs.

By accelerating the present rate of technical assistance, it is expected that the following accomplishments will be made during the 5-year installation period:

1. A total of 50 landowners or operators will become district cooperators.
2. A total of 70 basic farm and ranch plans involving the entire farm will be developed.
3. A total of 70 basic farm and ranch plans now in use will be revised.
4. Land treatment measures listed above will be installed.





## Structural Measures

Structural measures planned for this watershed consist of about 19 miles of single-purpose levee for flood prevention, 35 miles of multiple-purpose channel improvement for flood prevention and agricultural water management, and 3 multiple-purpose water control structures for flood prevention and agricultural water management. These measures are interdependent and must operate as a unit to provide the necessary protection.

### Levee

The levee will provide flood protection for a storm or tide event of about a 25-year frequency occurrence (exclusive of hurricanes) on Calcasieu Lake. The elevation which will provide this degree of protection is 5.0 feet mean sea level. An additional 2.5 feet of freeboard will be added to protect the levee against erosion by wave action. Wave wash presently is causing shore erosion of Calcasieu Lake. In order to protect the levee from this erosion, the levee will be constructed in the marsh at a distance of about 550 feet from the lake shore.

The levee will be constructed in three phases. The first contract will consist of "roughing in" the levee to a gross section that will provide fill for later shaping. This first work will be allowed to dewater and settle. Approximately 24 months after the awarding of the first contract, a second contract will be awarded to reconstruct the levee to the gross grade and cross section necessary. Due to uncertain foundation conditions, which will allow a varying amount of settlement, and dewatering conditions that may cause sloughing, a third contract may be necessary to bring the completed levee to the net grade and cross section. It is estimated this final work may be done during the fifth year of the project.

In order that small boats may reach Water Control Structure No. 1 during adverse weather conditions to allow operation of the structure in accordance with project goals, a continuous borrow canal will be maintained on the marsh side of the levee from approximate Station 65+00 to Water Control Structure No. 1.

The estimated installation cost of the levee is \$790,317.

### Water Control Structure No. 1

This structure will be constructed at the point where Grand Bayou enters Calcasieu Lake. In order to meet project objectives, this structure will have a series of regular control bays and one boat bay. Each regular bay will have an automatic floodgate on the downstream (lake) side, which will prevent entry of floodwater into the area; and a manually operated gate on the upstream (marsh) side, which will hold water in the marsh at the desirable level for management (see figure 2). The automatic floodgate will provide the same level of protection as the levee.



During periods of abnormally heavy rainfall the upstream gate can be manually opened to allow a more rapid rate of discharge of floodwater. During periods of extended drought, or when it is desirable for management purposes, one or more of the floodgates and/or manually operated upstream gates can be locked in an open position to admit beneficial water.

The boat bay will have a single gate which will provide the same level of flood protection as the floodgates on the regular bays. This boat gate can be manually opened to allow passage of small boats or to discharge or admit water for beneficial purposes.

During periods when normal water level in Calcasieu Lake is approximately that which is desirable for management of the marsh areas, any or all of these gates within the bays of Structure No. 1 may be held in an open position to allow beneficial exchange of water and to permit timely exchange of marine life into or from the natural waterways and nursery areas of the marsh.

Due to unusual foundation conditions which exist in this vicinity, firm foundation material is found at depths of approximately 25 feet below the existing ground surface. It is anticipated that it will be necessary to excavate the unsatisfactory material from the foundation of this structure, backfill the area with sand, allow foundation settlement for approximately two years, and then proceed with construction of the water control structure.

#### Water Control Structures No. 2 and 3

These structures will be "drop inlet" type structures and will operate as an integral part of the channel on which each is located. Water will be held on the upstream (marsh) side at a desirable elevation for management purposes. This will be the level of the crest of the drop inlet. When the water level inside the area is higher than this desired minimum, the excess water will discharge automatically from the area. An automatic floodgate on the outlet end of the conduit will remain closed to exclude floodwater originating outside the watershed, but may be held open to admit beneficial water for management purposes. An upstream gate in the inlet structure will be kept closed to maintain the minimum water level but may be opened to discharge floodwater at a more rapid rate during periods of storm runoff or to admit outside water to the area to maintain minimum levels during periods of extreme drought (see figure 3).

The estimated installation cost of Water Control Structures No. 1, 2, and 3 is \$447,784.

#### Channel Improvement

There are presently within the watershed about 35 miles of constructed channels. Natural waterways are not included in this amount. During periods of excessively high direct precipitation these channels remove the excess water in a timely manner to prevent damage to forage. None of these channels are adequate in their present condition to accomplish





project objectives, and planned structural measures to be installed include this improvement.

These channels to be improved, operating in conjunction with the water control structures, will also assist in control of minimum water levels and water fluctuations for management purposes. These channels serve both flood prevention and agricultural water management.

Where practical, spoil from channels will be stacked on alternate sides of channels that are improved. Excavated material from Channel No. W-1 West will be placed as a continuous levee along the north side from its intersection with the levee to the point where "back ridge" becomes pronounced. This is at approximate Station 90+30. This will prevent excessive drainage of these marsh lands adjacent to the refuge.

Where necessary for sediment control, a short recess for the purpose of sediment interception will be excavated at the junction of the lateral and the main channel.

New sections of channels will be constructed only for better alignment of existing channels or to more effectively utilize the existing land use patterns and water management systems.

The estimated installation cost of the channel improvement is \$709,431.

Bridges, culverts, gates, fences, pipeline crossings, or other existing structures which will need to be modified will be considered land, easements, and rights-of-way cost.

The details of the quantities, costs, and design features of all measures are shown in tables 1, 2, 3, and 3A.

#### EXPLANATION OF INSTALLATION COSTS

Public Law 566 funds are expected to provide technical assistance during the 5-year installation period to accelerate the installation of land treatment measures for watershed protection. These funds amount to \$37,620 and include \$2,120 for soil surveys on approximately 10,000 acres. An additional \$15,910 will be provided for technical assistance under the going programs in the watershed.

Local owners and operators will install land treatment measures at an estimated cost of \$180,600, which includes expected reimbursement from the Agricultural Stabilization and Conservation Service.

The costs of technical assistance are based on the going soil and water conservation district program. The cost of installing land treatment measures needed is based on present prices paid by landowners or operators to establish individual measures in the locality. The amount of land treatment measures needed is based on a study of conservation needs inventory data, on field surveys, and on interviews with local farmers and agricultural workers. This data has been adjusted for expected participation during the installation period.



The channels are multiple-purpose, serving both flood prevention and agricultural water management for range. All costs are allocated between these two purposes in accordance with standard procedures where the two purposes are inseparable. This results in 50 percent of the costs being allocated to flood prevention and a like amount to agricultural water management.

The levee is a single-purpose structure serving flood prevention. In order to meet project objectives at the least cost, a continuous borrow channel adjacent to the levee was planned. To meet non-project local needs, the sponsors requested the borrow areas be "staggered" along the southern end of the levee between approximate Station (-)40+65 and approximate Station 65+00. This change in construction procedures will require the use of more expensive land-based equipment in the first stage of construction. The added cost for this first stage caused by the increase in cost of construction is considered a non-project cost and will be borne entirely by the local sponsors. The local sponsors will provide a road to the southern end of the continuous borrow channel (at approximate Station 65+00) to allow ingress and egress to the continuous borrow channel for purposes of operation and maintenance.

The water control structures are considered an integral part of the system. They are multiple-purpose, serving both flood prevention and agricultural water management. Purposes are inseparable and costs are allocated 50 percent to flood prevention and a like amount to agricultural water management.

The total estimated cost of improving the 35 miles of channels is \$709,431. Of this amount, Public Law 566 will bear \$431,736 or 61 percent. The remaining \$277,695 or 39 percent will be borne by other funds. Of the amount borne by P.L. 566, \$295,110 is for construction and the remaining \$136,626 is for installation services. Of the amount borne by other funds, \$98,370 is for construction; \$177,325 is for land, easements, and rights-of-way; and \$2,000 is for administration of contracts. The estimated cost of land, easements, and rights-of-way includes \$37,800 for land; \$124,125 for the replacement or modification of all bridges or culverts which are not adequate for use following channel improvement; \$13,450 for the modification of public utility transmission facilities; and \$1,950 for miscellaneous work such as changes to fences, gates, side culverts, etc.

The total estimated project cost of installing the levee is \$790,317. Of this amount P.L. 566 will bear \$748,517 or 95 percent. The remaining \$41,800 or 5 percent will be borne by other funds. Of the amount borne by P.L. 566, \$555,600 is for construction and the remaining \$192,917 is for installation services. Of the amount borne by other funds, \$38,800 is for land, easements, and rights-of-way and \$3,000 is for administration of contracts. Non-project costs in the first stage of levee construction will be produced by requiring borrow areas to be "staggered" near the southern end, thereby increasing the construction cost and associated land, easements, and rights-of-way costs. This non-project cost is estimated to be \$35,580 and includes \$31,980 for the estimated increase in the cost of construction during the first stage and \$3,600 for the





increased cost of land, easements, and rights-of-way necessary. No increase in installation services is anticipated due to this change in construction methods.

No costs have been included for the easements which will be obtained for structural measures on the Federal land.

The total estimated cost of installing the water control structures is \$447,784. Of this amount P.L. 566 will bear \$362,084 or 81 percent. The remaining \$85,700 or 19 percent will be borne by other funds. Of the amount borne by P.L. 566 funds \$247,500 is for construction and the remaining \$114,584 is for installation services. Of the amount borne by other funds \$82,500 is for construction, \$200 is for land, easements, and rights-of-way, and \$3,000 is for administration of contracts.

Construction costs of all the measures include a 20 percent contingency allowance. Engineers' estimates are based upon previous construction costs of measures with similar construction conditions and adjusted to special conditions in the watershed.

The following table shows the estimated schedule of obligations for the 5-year installation period for both structural and land treatment measures. This schedule may be adjusted from year to year on the basis of any significant changes in the plan found to be mutually desirable in light of appropriations and accomplishments already made.



## Schedule of Obligations

Fiscal Year	Measure	P.L. 566		
		Funds	Other	Total
1st	Construction	526,468	18,810	545,278
	Installation Services	150,000	-	150,000
	Land, Easements, and Rights-of-Way	-	76,800	76,800
	Contract Administration	-	3,000	3,000
	Land Treatment	-	21,195	21,195
	Technical Assistance	9,010	3,390	12,400
2nd	Construction	339,165	113,055	452,220
	Installation Services	100,000	-	100,000
	Land, Easements, and Rights-of-Way	-	139,525	139,525
	Contract Administration	-	2,000	2,000
	Land Treatment	-	32,815	32,815
	Technical Assistance	7,950	3,390	11,340
3rd	Construction	198,130	49,005	247,135
	Installation Services	150,000	-	150,000
	Land, Easements, and Rights-of-Way	-	-	-
	Contract Administration	-	2,000	2,000
	Land Treatment	-	43,200	43,200
	Technical Assistance	8,160	2,970	11,130
4th	Construction	-	-	-
	Installation Services	20,000	-	20,000
	Land, Easements, and Rights-of-Way	-	-	-
	Contract Administration	-	-	-
	Land Treatment	-	44,540	44,540
	Technical Assistance	6,250	3,080	9,330
5th	Construction	34,447	-	34,447
	Installation Services	24,127	-	24,127
	Land, Easements, and Rights-of-Way	-	-	-
	Contract Administration	-	1,000	1,000
	Land Treatment	-	38,850	38,850
	Technical Assistance	6,250	3,080	9,330
Totals		1,579,957	601,705	2,181,662



It is anticipated that project agreements will be entered into to provide the following:

- First Year -
- (1) Rough in the levee to a gross section that will provide sufficient fill material necessary for later shaping, and
  - (2) Excavate unsatisfactory material from the foundation of Water Control Structure No. 1 and backfill the area with sand.
- Second Year -
- (1) Construct Water Control Structures No. 2 and 3, and
  - (2) Improve designated channels.
- Third Year -
- (1) Reconstruct the levee to the gross grade and cross section, and
  - (2) Construct Water Control Structure No. 1.
- Fifth Year -
- (1) Reconstruct the levee to the net grade and cross section.

#### EFFECTS OF WORKS OF IMPROVEMENT

Benefits from installation of the works of improvement proposed in this plan will depend upon the installation of needed land treatment measures. Establishment of these measures will assure the realization of the benefits claimed for project justification and will reduce the cost of project maintenance. A total of 113,000 acres and about 2,500 people will directly benefit from the installation of the project. Average farm income in the watershed will increase over \$600 annually.

Benefits evaluated will be realized through: (1) reduction of flood damages from floodwater originating outside the watershed and from a more timely removal of excess water originating within the watershed, (2) more efficient production and the higher level of management that may be expected from more effective agricultural water management, (3) the secondary effects stemming from and induced by project installation, and (4) incidental wildlife effects.

Intrusion of either salt or fresh floodwater into the watershed from Calcasieu Lake will be controlled to at least the level of the 25-year frequency event. Reduction in the damaging excess duration volume within the marsh will be approximately 73 percent.

Beef production per acre will increase over 25 percent once the risk of damage is reduced. With the installation of the proposed water control structures, the mortality rate of young calves will be materially reduced, since fewer calves will be dropped in high uncontrolled water. A stabilized water table will insure a more uniform quality of feed over





larger areas resulting in a higher percent conception of breeding cows. Uniform feed quality will also reduce periods of unstable gains and result in heavier and higher quality calves.

Harvestable production of desirable range species will increase as much as 2,500 pounds per acre. The conditions under which such excellent range plants as Marshhay cordgrass, Olney bulrush, and Smooth cordgrass will produce high yields will be maintained or increased. Stocking rates per animal unit may range from as high as 12 acres per cow to as low as 4 acres per cow. Ability to control such invading plants as Rattlebox, Bigleaf sumpweed, and Spiney aster will be enhanced. Water control will also make possible more intensive management of such range conservation practices as brush and weed control, controlled burning, and cattle walkways. Maintenance of the water level will reduce long dry periods which adversely affect marsh vegetation.

Installation of the project will not cause an increase in cropland or the production of surplus crops.

The present and anticipated future land use of the area both with and without the project installed is as follows:

Land Use	Present	Future Conditions	
	Conditions	Without Project	With Project
	(Acres)	(Acres)	(Acres)
Cropland	1,200	1,200	1,200
Pastureland	9,000	8,800	8,800
Rangeland	77,400	55,000	85,900
Miscellaneous <sup>1/</sup>	<u>25,400</u> <sup>2/</sup>	<u>48,000</u> <sup>3/</sup>	<u>17,100</u>
Total	113,000	113,000	113,000

<sup>1/</sup> Includes 14,926 acres of the Sabine National Wildlife Refuge.

<sup>2/</sup> Includes 8,500 acres of former rangeland which now has no value as such.

<sup>3/</sup> Includes 30,800 acres of former rangeland deteriorated to no value as such.

The application of measures for the conservation, improvement, and protection of the natural resources on at least 62,600 acres of land is in the public and private interest. The lands within the watershed are eligible to receive assistance from the going and accelerated conservation programs. The development of a long-range plan, resulting in the highest net family income, based on appraisal of production alternatives that will result in the most efficient use of his resources of land, labor, capital, and management is the objective for the improvement of the social and economic position of the individual farmer, especially those of low income. The application of conservation measures will contribute to the control of





excessive runoff, increase income potential, and aid in maintaining the effectiveness of group facilities for watershed protection and flood prevention.

Due to the location of 14,926 acres of the Sabine National Wildlife Refuge within the watershed boundary and the importance of wildlife on private land, the Local Sponsoring Organizations, the Soil Conservation Service, and the Bureau of Sport Fisheries and Wildlife have worked together to develop project measures that will benefit both range and wildlife.

The ability of the proposed structural measures to carry out the project objectives will allow incidental benefits to wildlife to accrue both within the refuge and on private land. The anticipated wildlife benefits will come in the form of a transition to more desirable vegetation in marsh areas and a more stable vegetation in ponds and shallow water areas. Some of the marsh is expected to change from a saltmeadow cordgrass to a three-square dominated type vegetation. The ponds and shallow mud flats are expected to maintain more consistent levels of water, and thus widgeongrass will be produced in these locations.

Adverse effects in the wildlife marsh adjoining Calcasieu Lake may be caused by encroachment of alligatorweed into this area. This noxious vegetation which plugs drainage systems and inhibits navigation will not tolerate salinities in excess of two parts per thousand. Until now, due to high soil and water salinities, it has been held west of a north-south line roughly paralleling the east refuge boundary. With the project in place, the waters of this area will become fresher, and this is expected to affect the westward extension of alligatorweed.

Other portions of the watershed will incur some wildlife loss due to accelerated drainage. The loss will be mainly to furbearers. These lands will be more extensively used for grazing. Such intensified land use can benefit goose populations, if grazing is not too intensive, by permitting young green shoots to grow while keeping heavy growth grazed down.

Local secondary benefits will accrue in the watershed and surrounding area due to installation of project measures. The values added to the immediate products and services as a result of activities stemming from or induced by project installation will enhance the overall local economy. The increased production of goods stemming from the project will place new demands upon the transporting, marketing, and processing industries in the area. Profits will be realized from increased sales of agricultural products by processors, business establishments, and other individuals not directly benefited. Increased expenditure will be induced for additional purchase of fertilizer, seeds, machinery, livestock supplies, and other needed materials or supplies by area residents. Increased net income will be obtained by those who supply the additional materials and services to make possible the increased net returns which stem from installation of project facilities. The goods and services produced by the project will tend to stimulate local economic activity on a more permanent basis.



Benefits will accrue due to the financial and technical assistance made available for the installation of the watershed project. The project will bring outside resources into the community and will provide an opportunity to use goods, services, and labor from the local area. The employment of unemployed or under-employed local labor will be needed during project installation and will provide for continuing employment throughout project life for normal operation and maintenance.

#### PROJECT BENEFITS

Direct primary benefits to range and wildlife are estimated to be \$168,732 annually. Of this amount \$72,601 are flood prevention benefits. Damage reduction benefits amount to \$66,599 of which \$13,121 is direct damage reduction and \$53,478 is inseparable damage reduction. More intensive use benefits amount to \$6,002. Agricultural water management benefits amount to \$60,020 of which \$36,015 is for increased efficiency. Incidental water management and water control benefits for wildlife amount to \$36,111. Project benefits were discounted for lag in accrual and lack of participation.

Secondary benefits stemming from and induced by the project were evaluated. Local benefits from these sources accruing annually are estimated to be \$27,034. It is recognized that secondary benefits from a national viewpoint will accrue in this watershed but these were not evaluated. Certain benefits resulting from a greater sense of economic security will also accrue.

#### COMPARISON OF BENEFITS AND COSTS

Total average annual benefits from structural measures are estimated to be \$195,766. The average annual cost of structural measures (amortized installation cost plus operation, maintenance, and replacement) is estimated to be \$92,238, providing a benefit-cost ratio of 2.1 to 1.

Average annual benefits without secondary benefits are estimated to be \$168,732, providing a benefit-cost ratio of 1.8 to 1.

#### PROJECT INSTALLATION

It is expected that project measures, both land treatment and structural, will be carried out in about a 5-year period. The sponsoring local organizations understand their obligations and have agreed to carry out the work to be done.

The soil and water conservation district will provide the overall leadership necessary for the application of the land treatment measures. Landowners and operators will be encouraged to apply and maintain all needed measures on their land. Plans for the installation and maintenance of these measures will be outlined with each landowner. The agreed-to items will be identified in a conservation plan which will be executed between the individual and the Gulf Coast Soil and Water Conservation District.





Cameron Parish Gravity Drainage Districts No. 3 and No. 4 will be responsible for providing the local share of funds for construction of structural measures; will provide all needed land, easements, and rights-of-way including all necessary modifications to existing bridges, culverts, pipelines, or other facilities; and will let and administer contracts. Channels to be improved, and designated on the project map as W-4, W-5, W-6, W-7, and W-1 East between Stations 528+41 and 785+64, are within the geographical limits of Gravity Drainage District No. 4. The remainder of the planned measures are within the geographical limits of Gravity Drainage District No. 3. It is anticipated that all channel improvement will be included in a single contract. This contract will be jointly administered by the two drainage districts. Contracts for the construction of the levee and the three water control structures will be administered by the Gravity Drainage District No. 3. Each of these districts has the right of eminent domain and has agreed to use these rights as necessary in acquiring needed land, easements, and rights-of-way for project installation. Each district will be responsible for acquiring those lands, easements, and rights-of-way within its geographical limits.

The channel improvement should progress in an upstream direction. Laterals should be constructed after work on the main channel has proceeded past the junction of the lateral concerned. Care will be exercised to insure the timely modification or reconstruction of bridges, culverts, etc., in order that they will not be a deterrent to proper functioning of the works of improvement. Construction of the structural measures will be in accordance with the construction schedule contained in this plan or as this schedule is adjusted from year to year on the basis of any significant changes in the plan found to be mutually desirable.

Technical assistance will be provided by the Soil Conservation Service to assist in design, preparation of specifications, supervision of construction, preparation of contract payment estimates, final inspection, execution of certificates of completion, and related tasks for the establishment of water control structures.

Installation services for multiple-purpose channels and flood prevention levees will be provided in part by the Soil Conservation Service and in part by the sponsoring local organization with engineering services available to it from the Louisiana Department of Public Works. The sponsoring local organization will make the detailed surveys, designs, and cost estimates; prepare plans, specifications, and land rights maps; supervise construction (excluding the inspection specified below); and prepare contract payment estimates. The price for each item of this work and conditions for reimbursement by the Service will be negotiated between the sponsors and the Soil Conservation Service and be documented in an agreement for engineering services before the engineering work is performed. The Soil Conservation Service will review and approve all plans and specifications provided by the sponsoring local organization before an invitation to bid is issued, and will make inspections during construction that are necessary to assure that the work is being constructed according to the contract or agreement requirements and will properly perform the





planned project purposes. Final inspections and certificates of inspection will be made jointly and without reimbursement by the Soil Conservation Service and the sponsoring local organization.

A project agreement will be entered into between the Soil Conservation Service and the sponsoring local organization before any contracts are awarded for the installation of works of improvement.

#### FINANCING PROJECT INSTALLATION

The Federal Government will finance its share of the costs of this project under the authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83d Congress; 68 Stat. 666) as amended. Financial and other assistance to be furnished by the Service in carrying out the project is contingent on the appropriation of funds for this purpose and the fulfillment of prior obligations by the project sponsors.

Gravity Drainage District No. 3 and Gravity Drainage District No. 4 of Cameron Parish are legally constituted organizations under the laws of the State of Louisiana. They have full authority to incur indebtedness and to operate and maintain works of improvement such as those proposed in this work plan. The Louisiana Department of Public Works has agreed to assist in the sharing of the local cost of these measures contingent on the appropriation of funds for this purpose by the Louisiana legislature. However, the local sponsors anticipate a need to obtain some financing from the Farmers Home Administration. The drainage districts have begun negotiations with this agency to borrow the funds necessary to install the planned measures. Local residents and property owners of each district will be assessed a tax against real property to provide the basis for securing these loans and to provide funds for operation and maintenance of structural measures.

It is recognized that all structural measures are interdependent and must operate as a unit to provide the overall project objectives and benefits; however, the local sponsors have requested that, except for Water Control Structure No. 1, each drainage district be responsible for providing the local share of construction cost for those measures which are within the respective geographical limits of these districts. Since Water Control Structure No. 1 will provide benefits to an extensive portion of Gravity Drainage District No. 4, as well as to Gravity Drainage District No. 3, these districts have requested that the portion of the construction cost for which the local sponsors are responsible be shared equally by the two districts.

The parish Agricultural Stabilization and Conservation Committee will cooperate with the governing bodies of the soil and water conservation district in selecting practices and providing financial assistance on those Agricultural Conservation Program practices that will help accomplish the conservation objectives in the shortest possible time.



## PROVISIONS FOR OPERATION AND MAINTENANCE

Operation and maintenance of all phases of the completed land treatment program will be the responsibility of non-Federal groups, agencies, and individuals.

The landowners and operators of the lands upon which the measures are applied under agreement with the Gulf Coast Soil and Water Conservation District will maintain the land treatment measures. The soil and water conservation district will assume the responsibilities for providing technical assistance to landowners for the maintenance of these land treatment measures. The objectives will be to maintain adequate conservation practices on the land so that full benefits from the project can be realized. Technical assistance necessary to advise and counsel on operation and maintenance of land treatment measures will be provided by the Soil Conservation Service.

Financial arrangements mentioned in "Financing Project Installation" are considered adequate to provide funds for operation and maintenance of the works of improvement to be installed. The estimated annual operation and maintenance cost of structural measures is \$14,746, based on adjusted normalized prices. These funds will be required to operate and continue the efficient functioning of the measures included in this plan. By placing a long-range maintenance program into effect, future efficiency of the system is assured.

Provisions will be made for representatives of the Soil Conservation Service, the Department of Public Works, the Bureau of Sport Fisheries and Wildlife, the Louisiana Wild Life and Fisheries Commission, and the local sponsors to have free access to all portions of works of improvement at any reasonable time for the purpose of inspection, repair, operation, or maintenance. Representatives of these groups will make a joint inspection annually, after unusually severe floods, and after the occurrence of any other unusual condition that might adversely affect the structural measures to an appreciable degree. These joint inspections will continue for three years following installation of each measure. Inspections after the third year will be made annually by the sponsors. They will prepare a report and send a copy to the Soil Conservation Service, the Louisiana Department of Public Works, the Louisiana Wild Life and Fisheries Commission, and the Bureau of Sport Fisheries and Wildlife. The inspections will include all items that have a direct bearing on the life and proper functioning of each of the measures.

Water Control Structure No. 1 is to be constructed on land administered by the Bureau of Sport Fisheries and Wildlife. Incidental benefits to be derived from its installation will accrue to fish and wildlife resources within the refuge area. The Bureau of Sport Fisheries and Wildlife has requested that they be assigned operation responsibility for this structure. The estimated annual cost of operation is \$1,487 based on adjusted normalized prices. This has been discussed with the local sponsors, and they agree to this method of operation.



The Gravity Drainage District No. 3 will be responsible for the maintenance of Water Control Structure No. 1; the operation and maintenance of Water Control Structures No. 2 and No. 3; and the maintenance of the levee and Channels No. W-2, W-1 West, and W-1 East between Stations 383+32 and 528+41. Gravity Drainage District No. 4 will be responsible for the operation and maintenance of an existing water control structure on Creole Canal (W-6 at Station 121+31) and an existing water control structure on King's Bayou (W-7 at approximate Station 15+00); and the maintenance of Channels No. W-1 East between Station 528+41 and Station 785+64, W-4, W-5, W-6, and W-7. The estimated annual cost of operation and maintenance of these measures is \$13,259 based on adjusted normalized prices.

The sponsoring local organizations fully understand their obligations for operation and maintenance and will execute a specific operation and maintenance agreement with the Soil Conservation Service prior to the execution of the project agreement for the installation of works of improvement.





TABLE 1 - ESTIMATED PROJECT INSTALLATION COST

Cameron-Creole Watershed, Louisiana

			Estimated Cost (Dollars) <sup>1/</sup>		
			Public Law	Other	
Installation Cost Item	Unit	Number	566 Funds	Funds	Total
<u>LAND TREATMENT</u>					
Soil Conservation Service					
Cropland	Acres	600	-	19,300	19,300
Rangeland	Acres	22,000	-	139,300	139,300
Wildlife	Acres	40,000	-	22,000	22,000
Technical Assistance			37,620	15,910	53,530
Subtotal - SCS			37,620	196,510	234,130
TOTAL LAND TREATMENT			37,620	196,510	234,130
<u>STRUCTURAL MEASURES</u>					
Soil Conservation Service					
Construction					
Water Control Structure	Number	3	247,500	82,500	330,000
Stream Channel Improvement	Miles	35	295,110	98,370	393,480
Levee	Miles	19	555,600	-	555,600
Subtotal - Construction			1,098,210	180,870	1,279,080
Installation Services					
Engineering Services			338,956	-	338,956
Other			105,171	-	105,171
Subtotal - Installation Services			444,127	-	444,127
Other Costs					
Land, Easements, and Rights-of-way					
Value of Land			-	76,800	76,800
Modification of Facilities			-	139,525	139,525
Contract Administration			-	8,000	8,000
Subtotal - Other Costs			-	224,325	224,325
TOTAL STRUCTURAL MEASURES			1,542,337	405,195	1,947,532
TOTAL PROJECT			1,579,957	601,705	2,181,662

<sup>1/</sup> Price base: 1965

January 1967





TABLE 1A - STATUS OF WATERSHED WORKS OF IMPROVEMENT

## Cameron-Creole Watershed, Louisiana

Practice	Unit	Applied to date	Total Cost (Dollars) <sup>1/</sup>
Brush Control	Acres	9,040	18,080
Cattle Walkways	Feet	250,000	80,000
Conservation Cropping System	Acres	600	600
Controlled Burning	Acres	10,000	500
Crop Residue Use	Acres	600	600
Range Deferred Grazing	Acres	11,000	3,300
Dikes and Levees	Feet	55,000	17,600
Drainage Mains and Laterals	Feet	12,500	3,750
Pasture and Hayland Management	Acres	4,500	5,625
Pasture and Hayland Renovation	Acres	1,500	52,500
Range Proper Use	Acres	29,700	4,455
Pumping Plant for Water Control	Number	1	1,500
Drainage Field Ditches	Feet	10,000	1,000
Well	Number	50	30,000
Wildlife Wetland Development	Acres	10,000	1,000
Wildlife Habitat Development	Acres	175	5,250
Wildlife Wetland Preservation	Acres	10,000	1,000
Land Smoothing	Acres	600	48,000
Pasture and Hayland Planting	Acres	4,500	157,500
Structure for Water Control	Number	2	120,000
TOTAL			\$552,260

<sup>1/</sup> 1965 Price Base

January 1967



TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION

Cameron-Creole Watershed, Louisiana

(Dollars) 1/

Structural Measures	Installation Cost - P.L. 566 Funds				Installation Cost - Other Funds					
	Construction		Engineering		Other		566 Funds		Total	
	:		:		:		:		:	
	:		:		:		:		:	
	Construction	Engineering	Other	566 Funds	Construction	of Contracts	and R/W	Funds	Total	Installation Cost
Multiple-purpose										
Water Control Structures	247,500	87,450	27,134	362,084	82,500	3,000	200	85,700	447,784	
Channel Improvement	295,110	104,272	32,354	431,736	98,370	2,000	177,325	277,695	709,431	
Single-purpose										
Levee	555,600	147,234	45,683	748,517	-	3,000	38,800	41,800	790,317	
(Non-project)	-	-	-	-	(31,980)	-	(3,600)	(35,580)	(35,580)	
TOTAL	1,098,210	338,956	105,171	1,542,337	180,870	8,000	216,325	405,195	1,947,532	

1/ Price Base: 1965

January 1967



TABLE 2A - COST ALLOCATION AND COST SHARING SUMMARY

## Cameron-Creole Watershed, Louisiana

(Dollars) 1/

Item	Purpose			Total
	:	:	:	
	:	Flood	Agricultural:	
	:	Prevention	Water	
	:		Management	

COST ALLOCATION

Single-purpose			
Levee	790,317	-	790,317
Multiple-purpose			
Water Control Structures	223,892	223,892	447,784
Channel Improvement	<u>354,714</u>	<u>354,717</u>	<u>709,431</u>
Total	1,368,923	578,609	1,947,532

COST SHARING

Public Law 566	1,235,861	306,476	1,542,337
Other Funds	<u>133,062</u>	<u>272,133</u>	<u>405,195</u>
Total	1,368,923	578,609	1,947,532

1/ Price Base: 1965





TABLE 3 - STRUCTURE DATA - CHANNELS

Cameron-Creole Watershed, Louisiana

Channel Designation	Station From	Station To	Drainage Area <sup>1/</sup> (acres)	Required Capacity Q=10M <sup>5/6</sup> (c.f.s.)	Hydraulic Gradient <sup>1/</sup> (ft./ft.)	Bottom Width <sup>1/</sup> (feet)	Sides Slopes	Design Depth <sup>1/</sup> (feet)	Velocity <sup>1/</sup> (ft./sec.)	Planned Capacity <sup>1/</sup> (c.f.s.)	Estimated <sup>2/</sup> Excavation (cu.yds.)	Elevation of Hydraulic Gradient at Outlet (ft.m.s.l.)
W-1	7445	383+32	6,700	71	0.00001	20	1½:1	7.4	0.36	71		0.00
	785+13	384+00	2,450	31	0.00001	14	1½:1	6.4	0.27	31	371,300	0.35
W-2	8+20	95+00	2,020	26	0.00005	4	1½:1	5.3	0.49	27	17,500	0.96
W-4	0+00	125+00	2,170	28	0.00005	6	1½:1	4.9	0.49	28	40,700	0.58
W-5	0+00	79+75	2,550	32	0.00005	6	1½:1	5.3	0.51	33	22,300	0.41
W-6	2+00	419+00	33,870	278	0.00002	38	1½:1	9.1	0.71	279	488,700	0.00
W-7	4+00	338+91	9,760	97	0.00003	25	1½:1	6.2	0.58	109	152,400	0.00

<sup>1/</sup> At lower station.<sup>2/</sup> Total volume for entire channel; includes overcut allowance.



TABLE 3A - STRUCTURE DATA

## WATER CONTROL STRUCTURES

Cameron-Creole Watershed, Louisiana

Structure: Number :	Type of Structure :	Drainage: Area :	Design Capacity:	Concrete: Volume :	Conduit: Diameter :	Conduit: Length :	Inside Water: Surface Elevation :	Top of Weir Outside : Gate : Length :	Elevation: (ft.m.s.l.) (ft.)
1	Two Way Semi- Automatic	50,520	708	232	-	-	1.0	5.0	50
2	Drop Inlet with Conduit and Flap Gate	6,700	76	-	2-48"	104	0.0	-	-
3	Drop Inlet with Conduit and Flap Gate	2,020	26	-	1-36"	50	1.0	-	-

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TABLE 4 - ANNUAL COST

Cameron-Creole Watershed, Louisiana

(Dollars)

	:	Amortization of	:	Operation and	:
	:	Installation	:	Maintenance	:
Evaluation Unit	:	Cost <sup>1/</sup>	:	Cost <sup>2/</sup>	:
					Total
Multiple-purpose Structures and Channel and Single- Purpose Levee		77,492		14,746	92,238
TOTAL		77,492		14,746	92,238

1/ Price Base: 1965 amortized for 50 years at 3 1/8 percent (0.03979).

2/ Adjusted Normalized Prices of the Water Resources Council, April 1966.

January 1967



TABLE 5

ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE REDUCTION BENEFITS

Cameron-Creole Watershed, Louisiana

(Dollars)<sup>1/</sup>

Item	<u>Estimated Average Annual Damage</u>				Damage Reduction Benefit
	:	Without	:	With	
	:	Project	:	Project	
Agricultural Range		91,776		24,504	67,272
TOTAL		91,776		24,504	67,272 <sup>2/</sup>

<sup>1/</sup> Adjusted Normalized Prices of the Water Resources Council, April 1966.<sup>2/</sup> One percent (\$673) attributable to land treatment measures.

January 1967





TABLE 6  
COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES

Cameron-Creole Watershed, Louisiana

(Dollars)

Evaluation Unit	Flood Prevention		Agricultural		Local		Average	
	Damage	Reduction <sup>1/</sup>	Intensive	Water	Incidental	Secondary	Annual	Benefit-Cost
			Land Use	Management	Wildlife	Benefits	Total	Cost <sup>2/</sup> Ratio
Multiple-Purpose Structures and Channels and Single-Purpose Levee	66,599	6,002	60,020	36,111	27,034	195,766	92,238	2.1:1
TOTAL	66,599	6,002	60,020	36,111	27,034	195,766	92,238	2.1:1

<sup>1/</sup> From Table 5

<sup>2/</sup> From Table 4

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## INVESTIGATIONS AND ANALYSES

### Land Use and Treatment Needs

Records of accomplishments, tabulations of conservation needs inventories, field surveys, and information from the work units of the Soil Conservation Service and other agricultural offices were used to determine the probable land use and treatment to be expected under going programs. The measures considered needed contribute to flood reduction, soil stabilization, or are needed to assure realization of benefits used in project justification. The land treatment measures are limited by degree of participation and the length of the installation period. Although some benefits will result from application of these land treatment measures, structural measures will be needed to attain the degree of watershed protection and flood damage reduction desired.

### Engineering Investigations

The following study was made to determine the structural measures for flood prevention and water management which would be feasible to install:

1. A base map was prepared showing the watershed boundary, drainage pattern, road system, and other pertinent information. A map of the watershed was prepared on which land use, soil types, and other pertinent data were shown. Quadrangle maps, aerial photographs, parish road maps, and other maps showing physical features were assembled and used to determine the best approach to locating needed structural measures.
2. The local sponsors determined the channels they felt should be included.
3. Profiles and cross sections of the proposed levee and channel improvement were surveyed by the Louisiana Department of Public Works. A topographic map was prepared for the site where each of the three control structures were located.
4. In the project area, it was determined that drainage curves would be used for design of main and lateral channels serving flood prevention and agricultural water management that were to be improved. Ample experience is available to determine that the agreed upon level of protection will be obtained by the use of drainage curves. The drainage curves are based upon the formula  $Q=10M^{5/6}$ , where Q is the average discharge in cubic feet per second and M is the drainage area in square miles. This criterion will provide about a 2-year level of protection against flood damage to marsh range and 3- to 5- year protection to cropland and pastures on the chenieres from rainfall runoff. A typical profile and cross section of channel improvement is shown in figure 1.
5. The levee was designed to protect against a storm that is expected to occur no more often than once in 25 years. It is recognized that



hurricanes occasionally strike this area. These storms are unpredictable, and this plan will not provide protection against occurrences of this type. The design elevation of the levee to provide a 25-year level of protection was determined to be 5.0 feet above mean sea level.

To prevent damage to the levee from occurring during the more intensive storm events by wave action, it was determined that a 2.5-foot freeboard allowance should be provided on the newly constructed levee. This freeboard will also provide additional protection from extreme damage anticipated from storm or tide events greater than the 25-year event for which the plan is designed. As described under "Geologic Investigations," it is anticipated that the erosion rate of the Calcasieu Lake shoreline will be 10 feet per year. The proposed levee was located 550 feet from the lake shore to provide allowance for this erosion without damage to the levee during the anticipated project life.

Geologic investigations revealed that organic material and soft clay overlay the firm foundation material to a depth ranging from 0 to over 42 feet. Due to this condition, provisions were made for a large settlement rate in the design and costs of the levee. Costs were included for a three-phase construction program. The first phase will consist of roughing in the levee to a gross section necessary to provide sufficient borrow to allow for initial settlement and dewatering. The second phase will be carried out about two years after the first, and will consist of reshaping the levee to a gross grade and cross section. About three years later the third phase will bring the levee back to net grade and cross section where necessary due to unusually high settlement, and correction of other problems such as sloughing will be made. Details of levee construction are shown in figure 4.

A portion of the levee, between Station (-)40+60 and 65+00 will be constructed with borrow pits on alternate sides of the levee. This type of construction is necessary to satisfy a request of the local sponsors. Alternate borrow pits will necessitate the use of land-based (walking) excavation equipment, thereby increasing the cost of construction for this portion of the levee on the first contract. The second and third contracts will not be influenced.

This additional cost is for the convenience of the local sponsors and has been determined to be a non-project cost. To allocate costs between flood prevention and non-project, two separate construction cost estimates were prepared for that portion of the levee designated above: (1) the cost of construction which would most economically meet project objectives, and (2) the cost using the method of construction necessary to meet the non-project desires of the sponsors.

A separate bid item will be desirable for the designated section of levee on the first contract.





6. Multiple-purpose water control structures proposed for flood prevention and water management are shown in figures 2 and 3.

Several design and construction problems were encountered during development of the plan, and several alternate plans were studied before the final decision was made as to the best plan to accomplish project goals. Problems encountered and considered were:

- a. Inaccessability of construction sites
  - b. Low shear strength of foundation materials
  - c. High consolidation of the foundation
  - d. Type and size of equipment needed for construction of the various alternate plans and ability to transport this equipment to the site
  - e. The need to provide ingress and egress to the marsh area through the structure for small boats.
7. Unit costs of structural measures were estimated based on the going rate of similar work in the general area. These costs were adjusted to meet the special conditions that exist in the watershed.

When the land treatment measures and those structural measures for flood prevention and water management had been determined, a table was developed which gave the total cost of each type of measure. The summation of the total costs for all needed measures represented the estimated installation cost of the project (table 1). A second table was developed to show the annual costs of installation and operation and maintenance of the structural measures (table 4). Pertinent physical data for individual structural measures was summarized in tables 3, 3A, and 3B.

#### Hydraulic and Hydrologic Investigations

Basic data used in the hydraulic and hydrologic investigations included:

1. Water stage records in charts and publications by the U. S. Army Corps of Engineers and the Louisiana Cooperative Fisheries Unit
2. Rainfall records and frequency analyses published by the U. S. Weather Bureau
3. Evapotranspiration rates published by the U. S. Agricultural Research Service
4. Profiles across the marsh surveyed by the Louisiana Department of Public Works and the Soil Conservation Service
5. U. S. Coast and Geodetic Survey quadrangle sheets.



The maximum stage frequency for Calcasieu Lake and Calcasieu Pass was determined by computing the maximum stage frequency at the Hackberry and Cameron gages. The frequency curves were almost identical, and indicated a 25-year maximum stage of 5.0 feet above mean sea level. The design levee height was set at this elevation. It is recognized that protection from high stages occurring during hurricane events is beyond the scope of this plan. These events were not used in determining maximum stages.

The effectiveness of Structure No. 1 was determined by routing through it the runoff from the rainfall of a 30-day period which would have a 20 percent annual chance of occurrence. Actual rainfall and outside stage records were used in the routing. An accounting was made of the effect of evapotranspiration, storage, and outflow on the drawdown in the sump area. Outflow rates were based on submerged weir flow relationships when applicable. The routing indicated that the design shown in table 3A will meet the project objective of removing excess waters from a 5-year event in 30 days.

A comparison of present stage conditions in the marsh and with project conditions shows an average annual reduction in excess volume times duration of 73.3 percent attributable to the project.

A study was made of the effect of Structure No. 1 on marsh water levels under drought conditions. Four periods (of approximately 5 months duration each) for which rainfall and stage records were available from the Hackberry gages were used. The periods included the four worst droughts of the period of record. A routing of flows through the structure for each period was made. A methodical procedure for regulating flows was assumed, with decisions based on observed water stages at the time the decisions were made. Occasionally the flow through the structure was reversed. The routings indicated that during non-wet periods the marsh water levels affected by Structure No. 1 could be controlled in a practical manner to minimize excessive drainage and fluctuation.

The design flow capacities for channel improvement and Structures No. 2 and No. 3 were computed by using the empirical formula  $Q = 10M^{5/6}$ , where  $Q$  is the required capacity in cubic feet per second, and  $M$  is the drainage area in square miles. Long-term observations by drainage engineers have shown that the above formula provides the economically optimum capacity for normal marsh use.

The effect of structural measures on maximum stages from rainfall with the watershed was studied. Excess rainfall frequencies were developed and routed through the structures to obtain maximum stage frequencies. The study indicated that no increase in damages to physical improvements will be caused by structural measures.

#### Economic Investigations

Information was obtained from landowners and operators, agricultural workers, and wildlife specialists relative to average yields under present and future conditions with and without the project installed.



Production budgets were developed with the assistance of local landowners, agricultural workers, and producers to reflect the differences in production costs and prices received under present conditions and with project conditions.

Damage reduction to range was developed from information furnished by the hydrologist and range conservationists. The reduction in the volume of water that is in excess of the amounts necessary for optimum wildlife and range conditions was estimated to be 73.3 percent. This percent was used to reflect the damage reduction by flood prevention. Damages from flood-water (which is alternately salt Gulf water and fresh water from the Calcasieu River) were calculated utilizing the reduced amounts of range available in the future due to this condition.

Installation of the project will induce some operators to increase production inputs and allow them to perform normal operations in a more timely manner. It is estimated from budgets that more intensive land use benefits will amount to about 10 percent of the total flood prevention benefits to range lands.

Data was developed showing average production for the various range condition classes under the future conditions with and without the project installed.

The following data were developed for the watershed:

1. Yields and production costs for the various range condition classes
2. Land use and production under future conditions with and without the project
3. Secondary benefits
4. Flood damage reduction due to project
5. Data concerning wildlife enterprises.

Wildlife budgets and yields with and without the project were developed in cooperation with fish and wildlife biologists of the SCS and BSFW. Values and fees for wildlife resources were collected from local trappers and hunters and compared with data provided by these biologists.

Adjusted normalized prices were used for development of operation and maintenance costs and for all production budgets.

Secondary benefits were calculated as those local benefits stemming from and induced by project installation. It is recognized that secondary benefits from a national viewpoint will accrue to this project, especially within the wildlife area, but no attempt was made to evaluate them.

Benefits claimed for project justification are net benefits. Production and associated costs have been deducted. Gross benefits have been discounted





for lack of participation and lag in accrual. Installation cost of structural works of improvements was reduced to average annual cost by amortizing for 50 years at 3 1/8 percent interest. Total average annual benefits are in excess of average annual costs.

### Geologic Investigations

During the geological investigation the following reference material was used:

1. Geological Bulletin No. 6 (Reports on the Geology of Cameron and Vermilion Parishes, published by the Louisiana Department of Conservation and the Louisiana Geological Survey)
2. Aerial photographs taken in 1947, 1953, and 1964
3. Topographic maps prepared by the U. S. Geological Survey and the U. S. Army Corps of Engineers.

An examination of topographic maps and a field reconnaissance established the minor nature of the amount of sheet erosion.

Shoreline erosion on Calcasieu Lake, due primarily to wave action, was established as being an item of major importance in relation to the location of the levee along the east side of this lake. Comparison of aerial photographs taken over a 17-year period established an average shoreline recession rate of approximately 10 feet per year. This rate was confirmed by work done by the Coastal Studies Institute at Louisiana State University. Considering the project life of the project, the levee was planned to be 550 feet from the present shoreline.

Sediment derived from the shoreline recessions is not delivered directly into the watershed.

Due to the lack of appreciable sheet erosion, and the lack of a well developed drainage pattern, sedimentation from this source is negligible. Normal maintenance is sufficient to remove this sediment from improved channels. Silt bars are deposited in the natural waterways by retreating floodwaters, but this sediment is derived from the silt and organic material on the bed of the Calcasieu Lake.

Subsurface investigations were made by drilling test holes along the line of the proposed levee and at the locations of the proposed water control structures. Vane shear tests and undisturbed samples for laboratory analysis were taken from representative materials in the vicinity of Water Control Structure No. 1.

Materials encountered in the drilling ranged from firm Pleistocene clays at the surface in the northern portion of the levee to an excess of 40 feet of soft, gray, organic clay at the surface in the southern part. This Recent soft, gray, organic clay overlies the firm Pleistocene clay and has an average thickness in the vicinity of the proposed levee of about 22 feet.





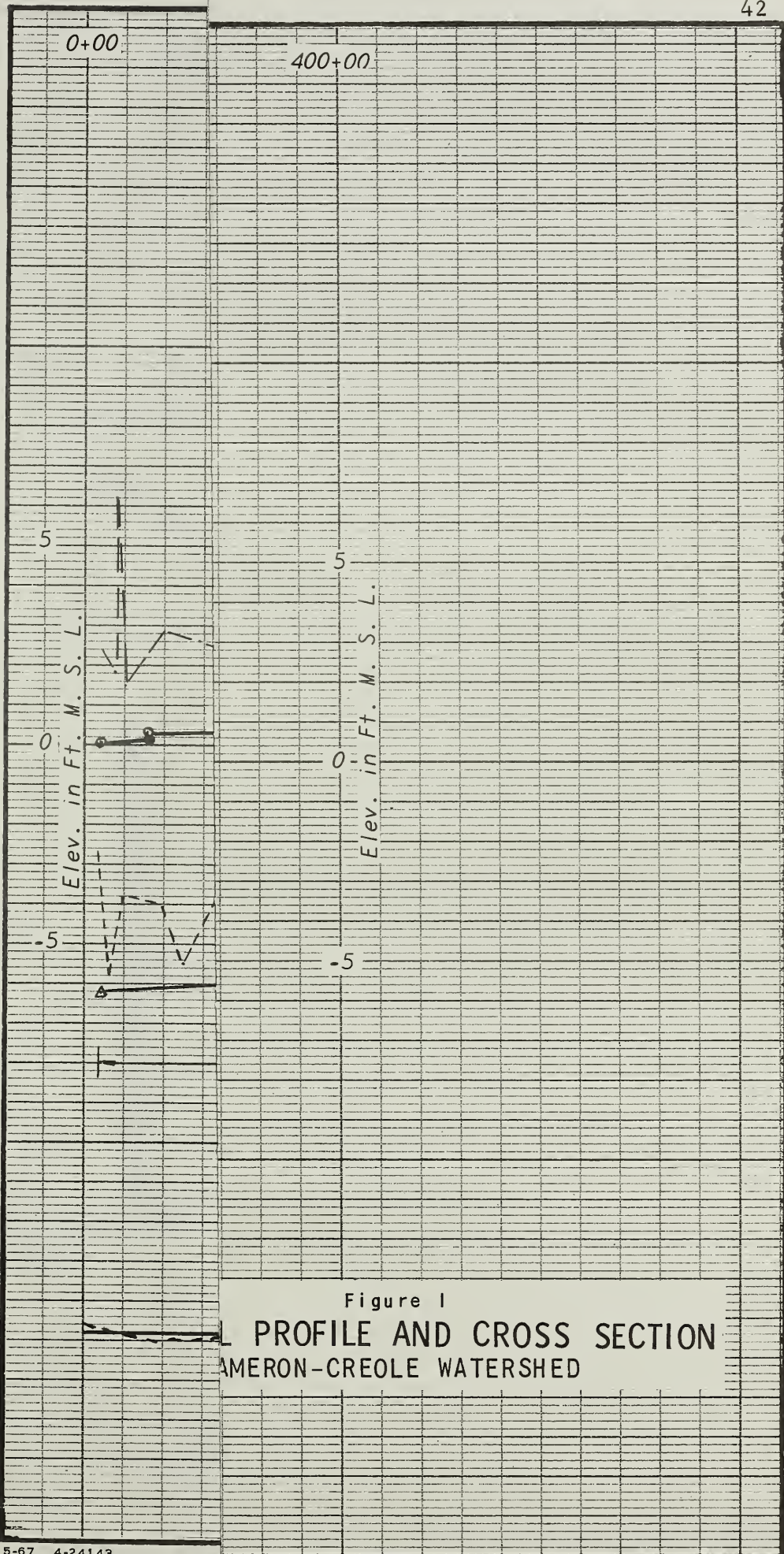
Vane shear tests of this Recent clay indicated a shear strength of approximately 200 pounds per square foot. Consolidation tests showed about 25 percent primary consolidation under a 2,000-pounds-per-square-foot loading.

The material for constructing the levee will consist of the soft, organic clay and will be borrowed in the vicinity of the levee. Due to the weakness of the foundation and to the high consolidation anticipated, multiple-stage construction of the levee will be required. This weak material will be excavated from the foundation of Water Control Structure No. 1 to the firm Pleistocene material and will be backfilled with sand.

#### Fish and Wildlife Investigations

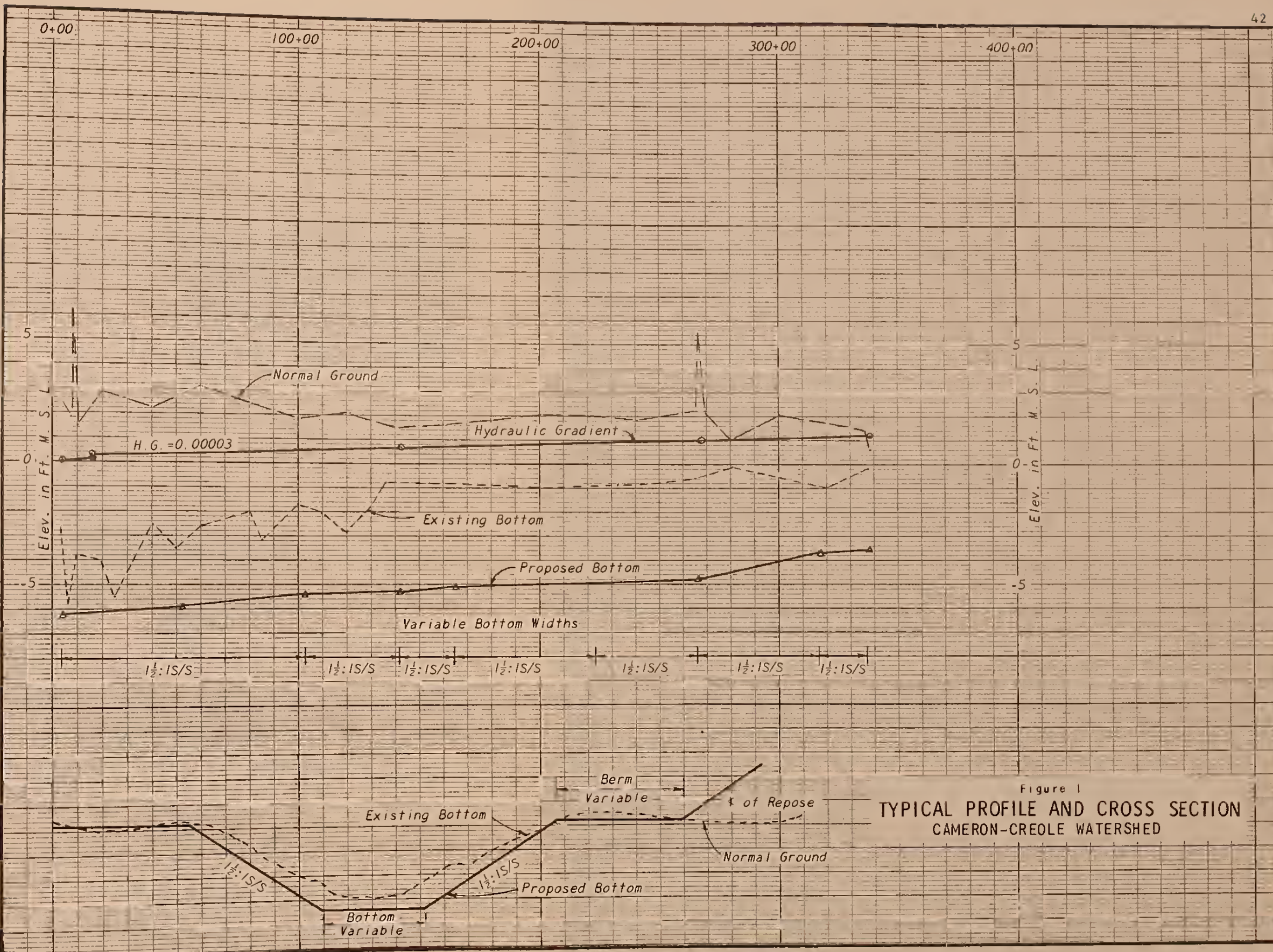
The impact this project will have on the existing fish and wildlife resources was carefully studied by personnel of the Bureau of Sport Fisheries and Wildlife, the Louisiana Wild Life and Fisheries Commission, and the Soil Conservation Service. Transects through the marsh were surveyed, and vegetative types of sample areas and relative water conditions were established. Using the results of this ecological study and information furnished by the hydrologist concerning water conditions under present and anticipated with project conditions, the capability of the structural measures to improve fish and wildlife resources was studied and incidental fish and wildlife benefits which will result from project installation were determined. Adverse effects were considered in determining the net benefits to be gained from the project.















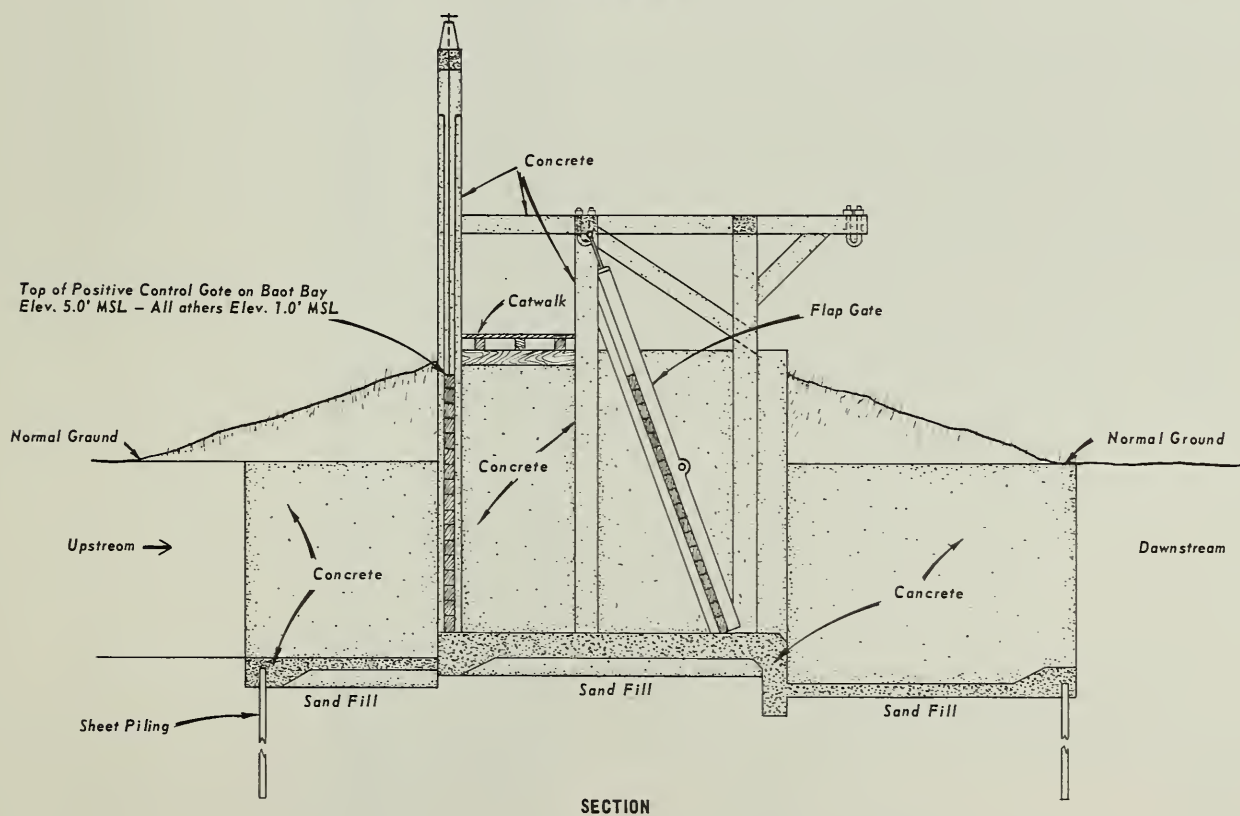
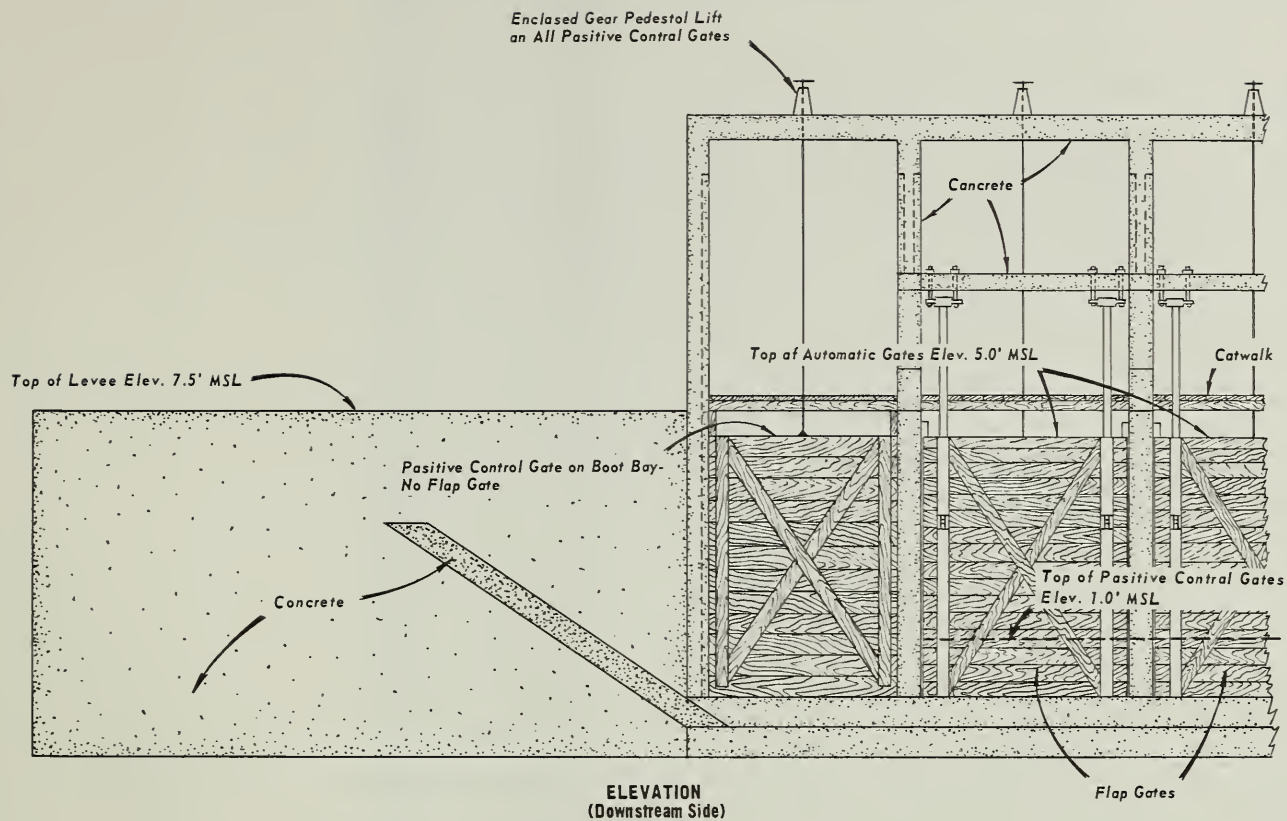


Figure 2  
TYPICAL PLAN  
WATER CONTROL STRUCTURE NO. 1  
CAMERON-CREOLE WATERSHED  
CAMERON PARISH, LOUISIANA





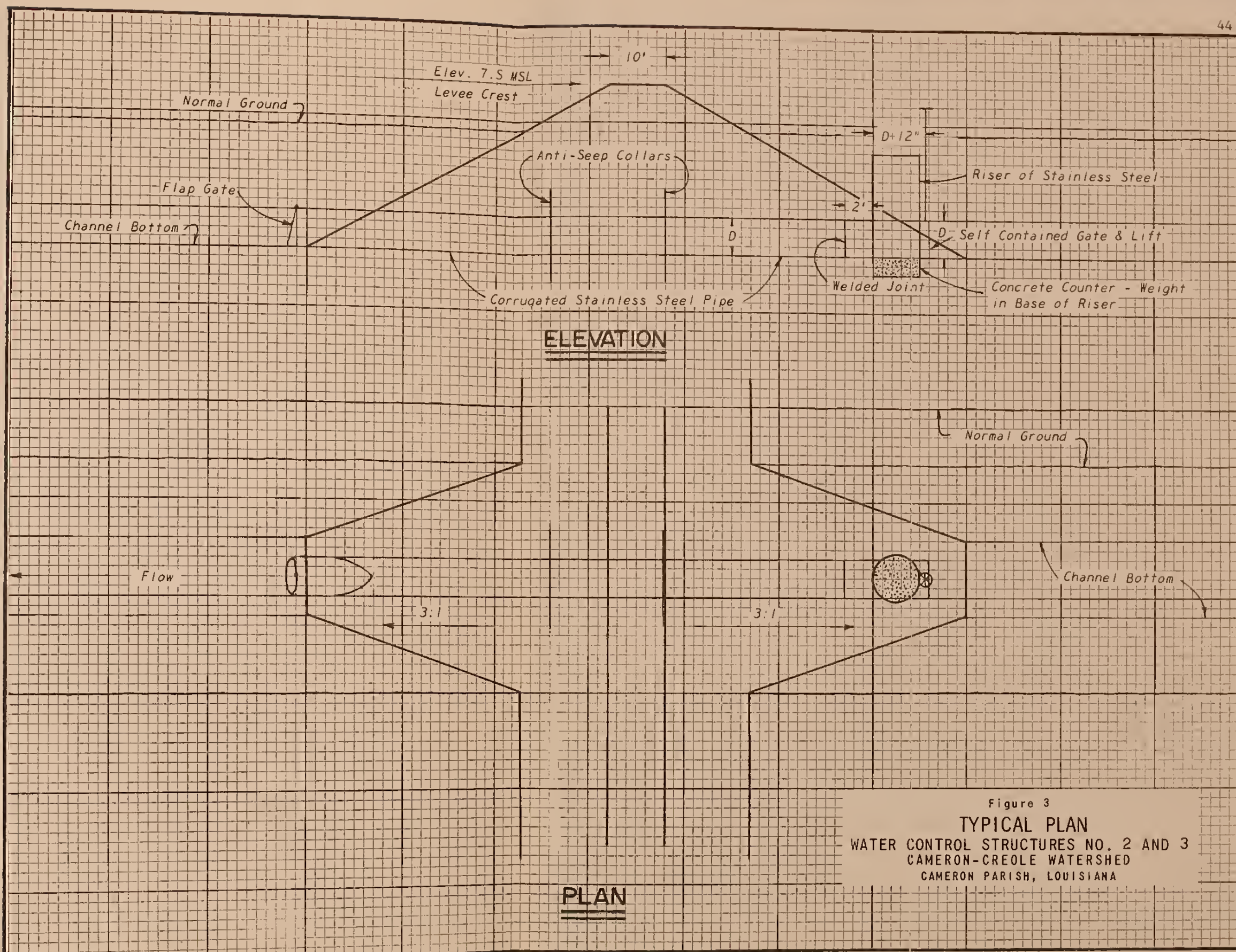
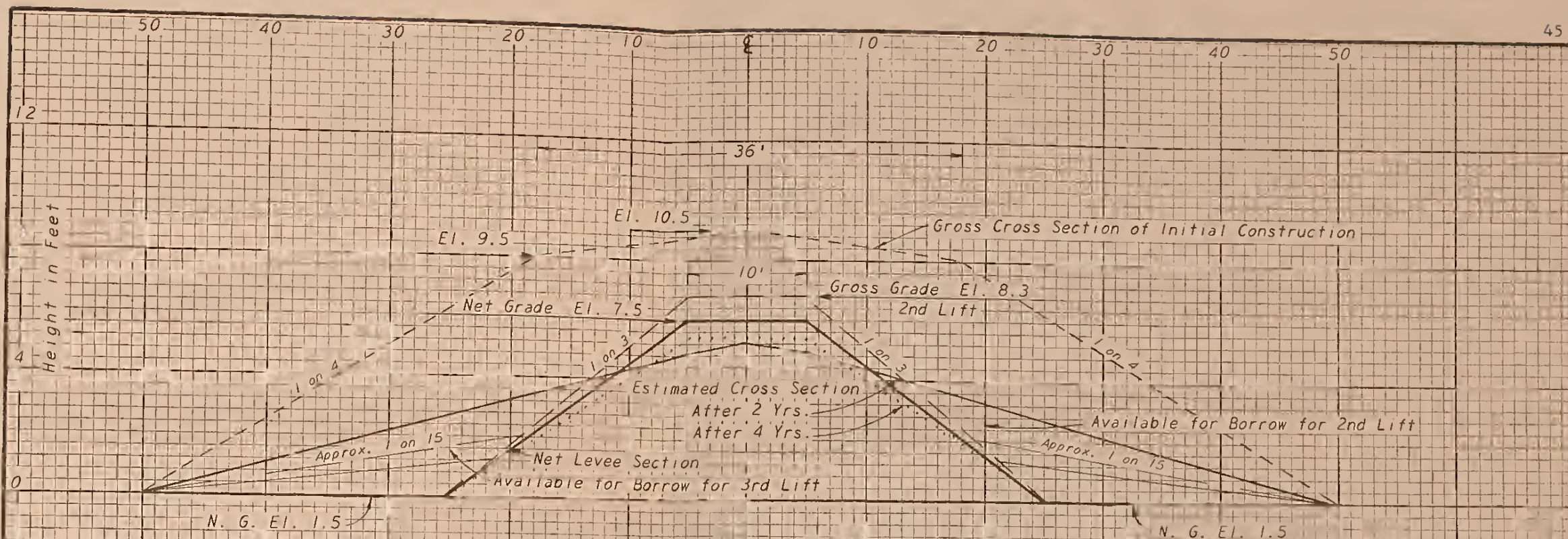


Figure 3  
**TYPICAL PLAN**  
 WATER CONTROL STRUCTURES NO. 2 AND 3  
 CAMERON-CREOLE WATERSHED  
 CAMERON PARISH, LOUISIANA

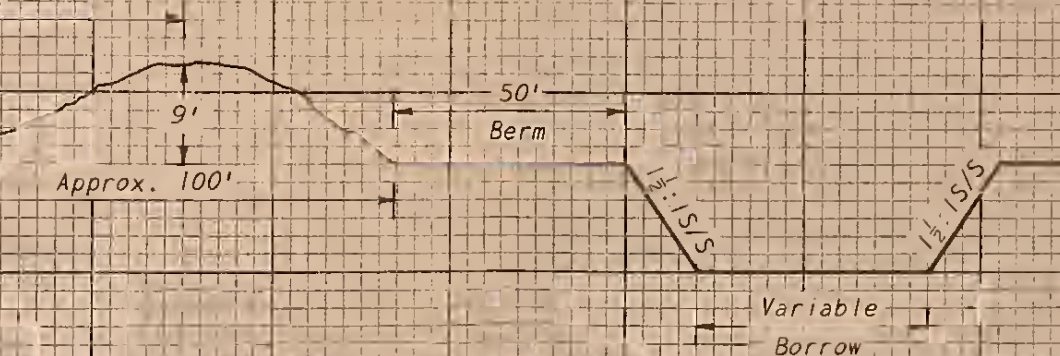






## LEVEE CROSS SECTION

600' to Calcasieu Lake



## TYPICAL SECTION INITIAL CONSTRUCTION

Figure 4

PROPOSED LEVEE CONSTRUCTION  
CAMERON-CREOLE WATERSHED







- LEGEND**
- Paved Road
  - Improved Road
  - - - Unimproved Road
  - - - County Line
  - - - Pipeline
  - Levee
  - Existing Control Structure
  - Drainage
  - Marsh
  - Town
  - - - National Forest Boundary
  - - - Watershed Boundary
  - Proposed Levee
  - Proposed Water Control Structure
  - Proposed Channel Improvement
  - Benefited Area



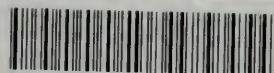
Figure 5  
**PROJECT MAP**  
**CAMERON-CREOLE WATERSHED**  
 CALCASIEU AND CAMERON PARISHES  
 LOUISIANA

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